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Electrical World

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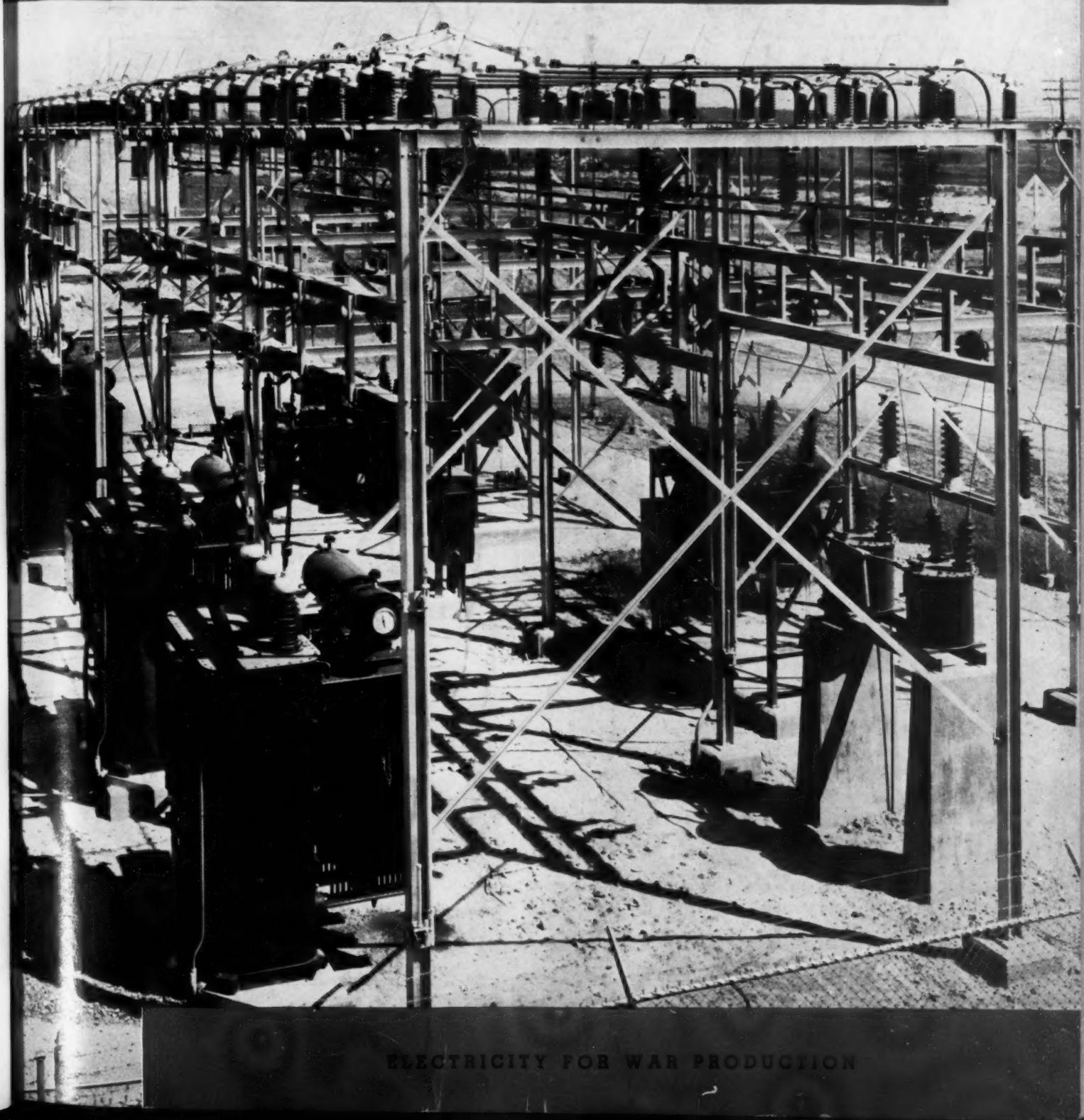

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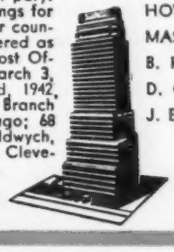

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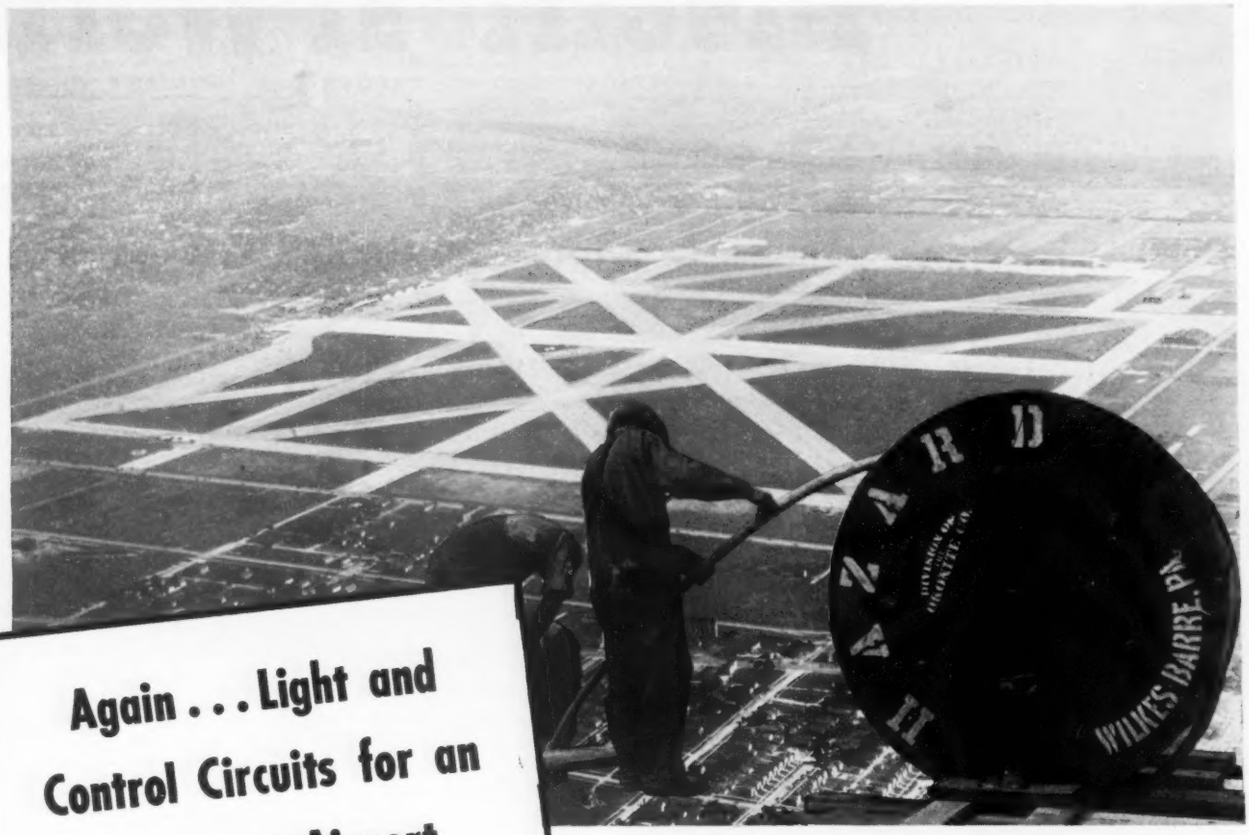

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Victory at Home

Although the annual statistical review of the year just closed will not appear until the next issue, there are certain observations that one might make with respect to the year ahead of us that do not need to be fortified by figures. The most obvious thing, of course, is that as the year rolls on everything we do or plan will be tinged with war.

There will be many more regulations and restrictions. Some places will have power rationing. Some places will have blackouts. Shortages of materials may result in requisitioning of inventories. Skilled labor will be scarcer than ever, and as the numbers in the armed forces grow employment problems will arise.

We wish we could predict a diminution of regulatory demands, but there seems to be no indication that such might be expected. Changes in regulatory personnel might have this effect, but at this time such ideas would be purely wishful thinking.

The longer this war continues the more profound will be the lasting effects. No one can predict how long it will take, and for that reason it is best to prepare for a war of several years. On such a basis the things that one would do with a utility system would be different than if the outlook were for a very short war. Many things could be neglected now if next year or the year afterward we were back to peaceful operations. We cannot be sure, and therefore we should not engage in temporary practices that are bound to be harmful in the long run.

It is also apparent now that the year will bring further restrictions on construction and on the manufacture of civilian supplies. The effect of both will be to curtail sales efforts. Nothing more disastrous could happen to the utility companies than to stop selling just because there was less equipment to sell. What are utilities in the business for, to sell appliances or service? Even if the customers were not able to get new equipment, would they stop being regular customers? It all seems so silly to talk about ceasing to sell when the customers haven't stopped buying.

Maybe this year, by focusing attention on the really important things, will prove a boon to utility companies. It isn't nearly as important that a customer buy an appliance as it is that the customer continue to want the company's service. Some time during the year service may have to be interrupted at certain hours. Are the customers going to be told by a cold announcement or are salesmen going to keep them happy because they understand?

Because of so many new problems, the need this year for getting together with others in the same business will be more and more necessary. And especially will this be true of the operating executives who will have to make operating policies. It would almost be worth a war if these men could have the confidence in and respect for each other that would cause them to work together harmoniously under a leader and with a program.

Some of the things we do this year because of the war will be difficult and some will be distasteful, but this much is certain: If whatever we do we do as well as we know how, we may be surprised when peace comes to see how much that was done in the name of war emergency becomes an outstanding bit of peacetime practice.

There's such a thing as victory back home as well as on the front.

Santee Diverted to Cooper for Tidewater Hydro

Within 30 miles of tidewater, the 75-ft. head development involved 27 miles of earth dikes — Generating station is 18 miles remote from spillway — Electrical set-up highly flexible

L. H. HARDIN, South Carolina Public Service Authority*

FOR THE 181,350-kva. Santee-Cooper development the Santee River is being impounded and the water diverted to the tidal estuary known as the Cooper River, which discharges into the sea at Charleston. Unique features of the development are (1) a 75-ft. head utilized less than 30 miles from tidewater, (2) the construction of 27 miles of earth dikes, (3) the 75-ft. lift for the navigation lock is the highest single-lift in the country, (4) highly flexible means for pairing combinations of generators and lines to meet any likely character of load.

Santee-Cooper project is located in a region largely devoid of industrial development, in which the needs for power prior to the defense emergency were amply served by existing utilities. The project has as its prime function the attraction of new industries, but the character, extent and location of these were wholly unknown when basic development plans were formulated. These circumstances imposed on the designing engineers the necessity of providing for the utmost flexibility in generation and switching. To meet this, in part, the turbines, all propeller runner type, are nearly equally divided as between fixed and adjustable blade. Likewise, each generator-transformer unit is allocated an individual bay in the 115-kv. switchyard. With double 115-kv. buses, a high degree of flexibility is provided for pairing combinations of generators and lines and of utilizing in the most effective manner the high reduced-load efficiency of the adjustable blade turbines.

This project involves the ultimate installation of five (four initially) 34,000-kva. units and one of 11,350 kva. (initially) for a total of 216,000 hp. Average-year generation is expected to be 700,000,000 kw.-hr., of which 400,000,000 will be primary.

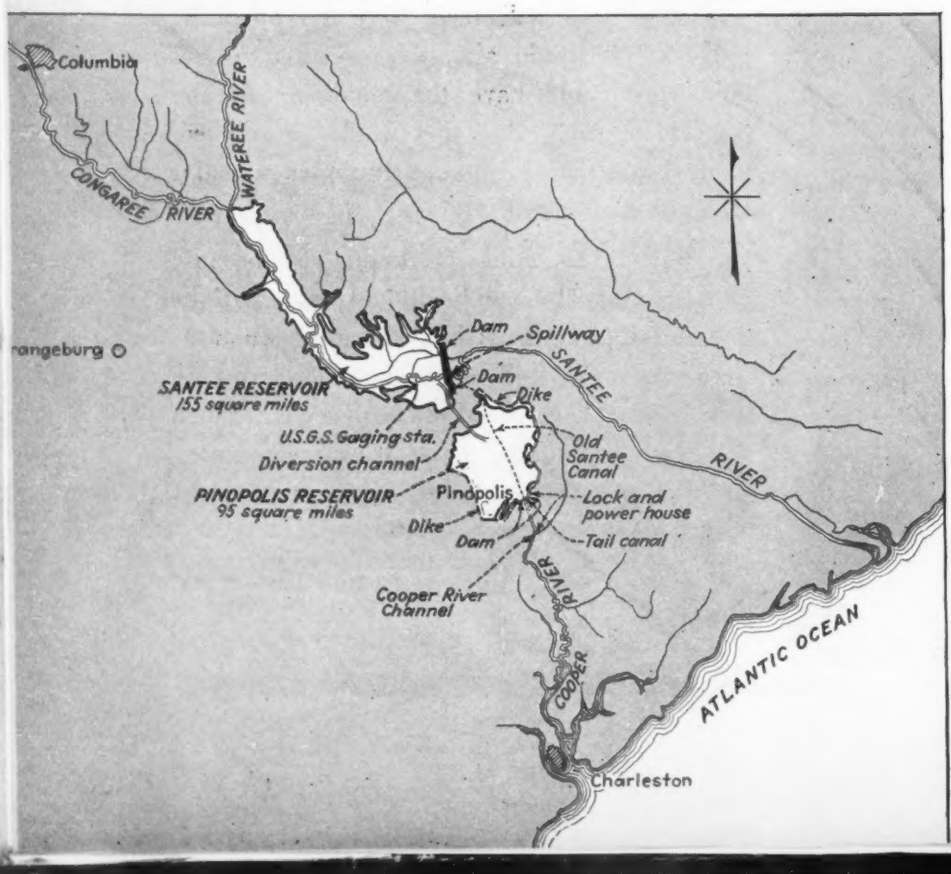
To achieve the development the Santee River is being impounded and diverted into the tidal estuary, known as the Cooper River, by a 3,400-ft. long spillway equipped with 62 tainter gates operated by two gas-electric powered gantry cranes. The waters thus stored form two reservoirs, the upper (Santee) and lower (Pinopolis) pools, these being joined by a connecting channel. To confine the Pinopolis pool 27 miles of earth dikes are required. The generating plant, being constructed at the juncture of the Pinopolis pool and the old Santee Canal, presents the unusual sight of a major hydro-electric plant being constructed on a site with no river near, the impounding spillway being 18 miles distant.

The "unit" plan of switching and control is employed, wherein each generator and its own transformer bank are switched as a unit.

Generating units are of the totally inclosed type with internal coolers, arranged for the introduction of CO_2

*Principal electrical engineer.

SANTEE WATER diverted to Cooper River to create 75-ft. head development close to seaboard

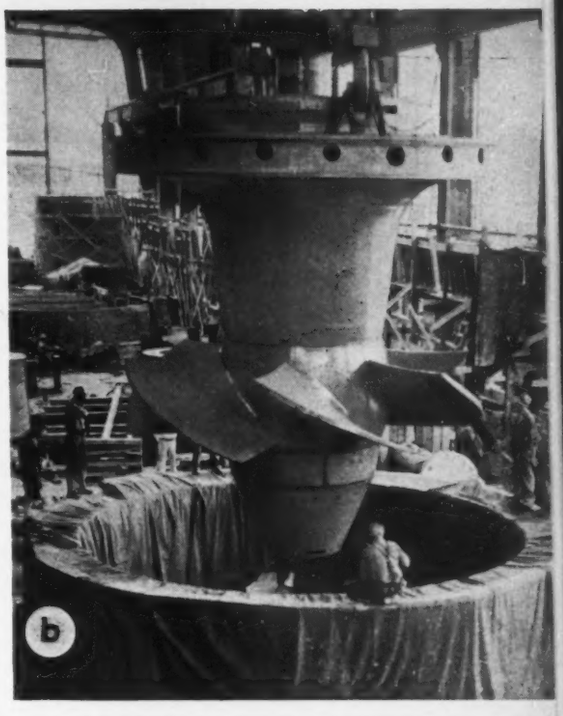


gas from a header by a selectively tripped solenoid valve on the occurrence of internal fault, with simultaneous clearing of main circuits associated with the unit, generator field and shut-down solenoid of governor.

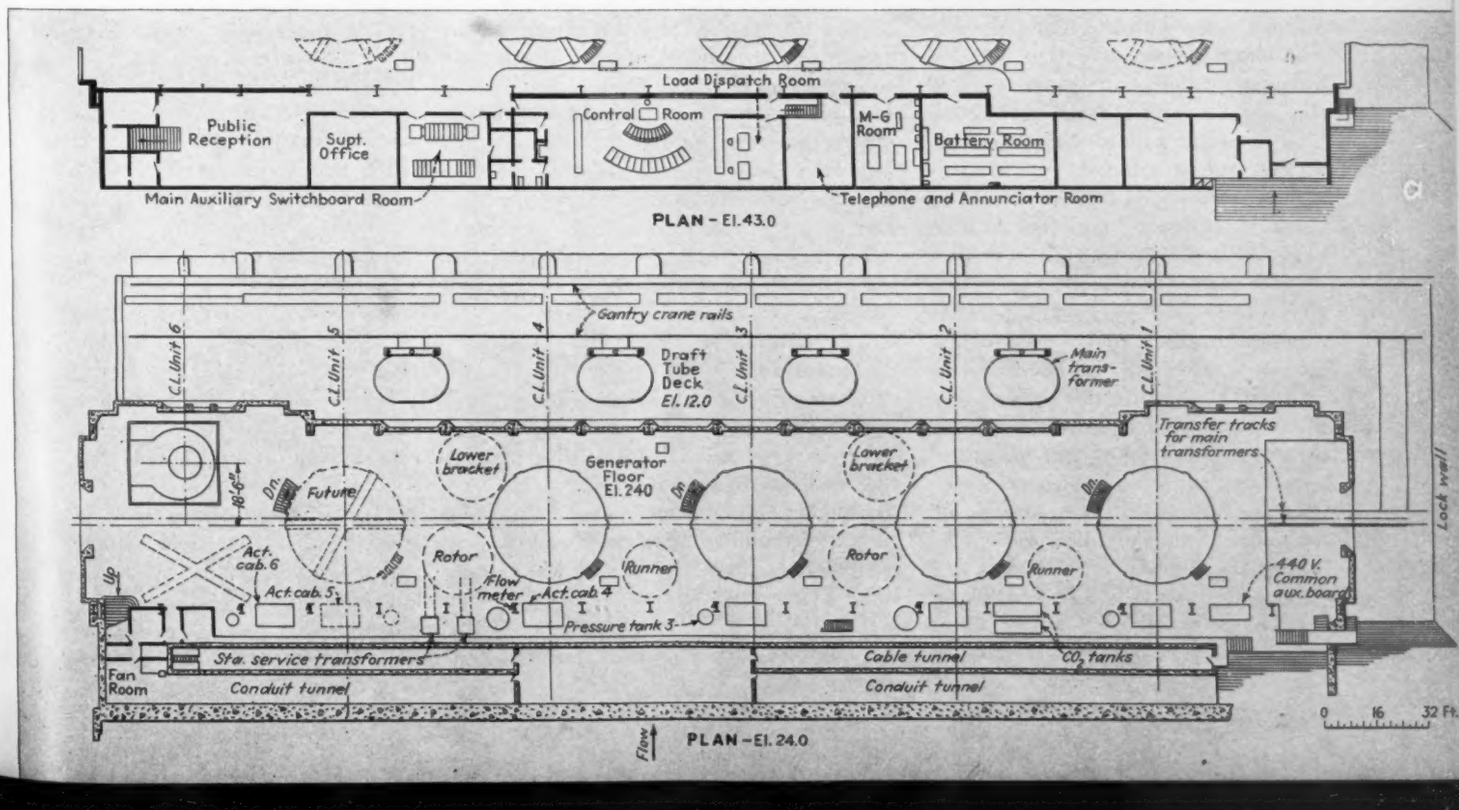
Excitation is of the quick-response type with main and pilot exciters, with full facilities for the recovery of unit voltage under runaway conditions. Due to high prevailing humidity, it was deemed necessary to install heaters in the generator housings under thermostatic control, to maintain the temperature above the dew point to prevent condensation after shut-down. Unit auxiliaries such as air compressor, for maintaining constant oil counter pressure in the hubs of the adjustable blade units, oil and water pumps, sump pumps, etc., are arranged for group supply from an individual bus installed in the governor actuator cabinet, so that energizing this bus automatically brings essential auxiliaries associated with a particular unit into service. The individual circuits of these auxiliaries are in turn supervised by a closed-circuit system of alarm and annunciator indication so that failure of any one of these is immediately brought to the attendant's attention. That certain auxiliaries do actually function and deliver oil, water, etc., is supervised by flap type "no-flow" indicators.

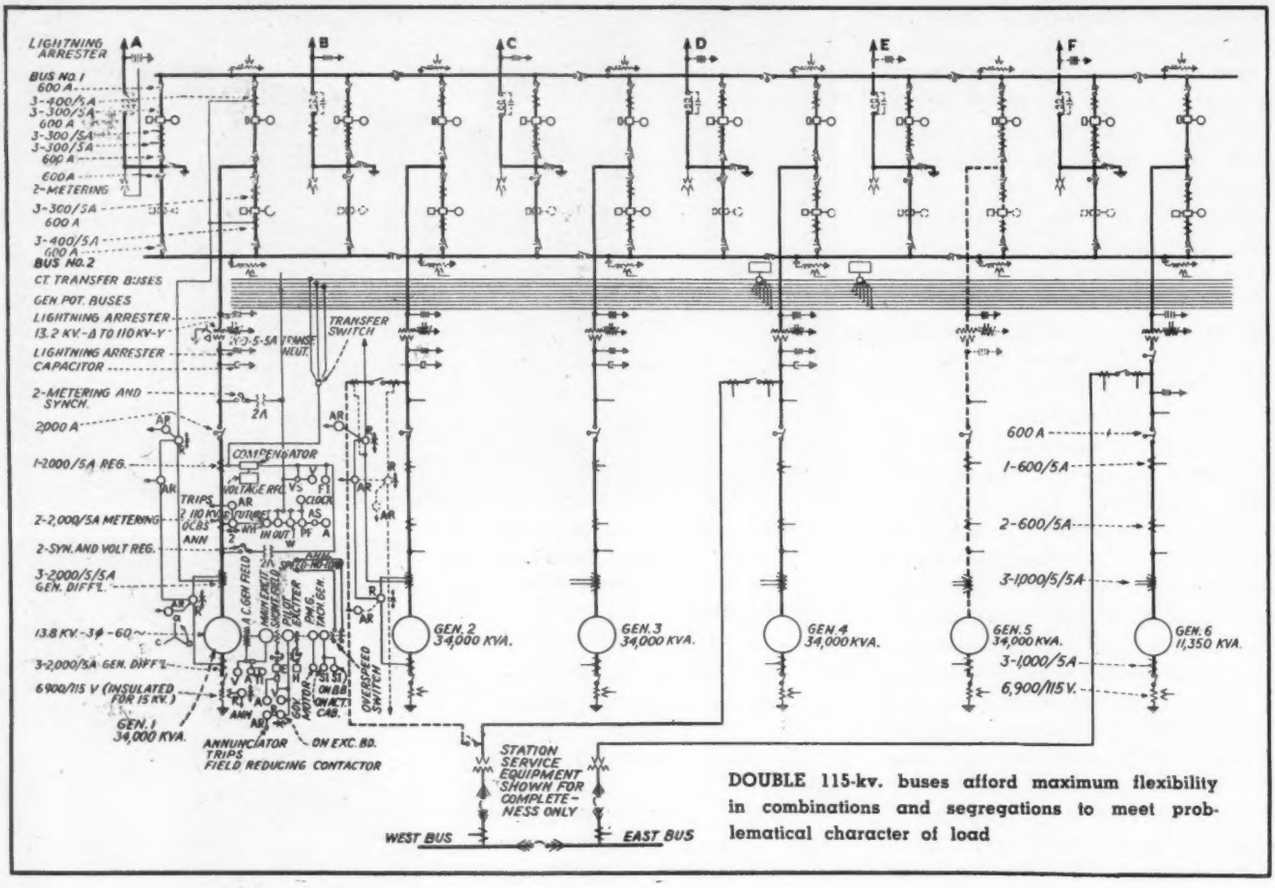
Station auxiliary service is derived from two 1,000 kva.-13,800/440-volt transformers connected directly to generating unit without intervening oil circuit breakers. Distribution of auxiliary power is from duplicate 440-volt buses, essential services being brought to each bus. These 440-volt buses will normally be paralleled and served from a single auxiliary bank or may be split and each served from its own bank. Transfer of auxiliaries from one generating unit to another is to be accomplished by a momentary interruption of auxiliary service, thus the paralleling of generating units though the auxiliaries banks is

SPILLWAY, 3,400 ft. long, on Santee pool has 62 tainter gates. Floodwater discharged down Santee. Pondage channeled to Pinopolis pool



FIVE (one future) 34,000-kva. and one of 11,350 kva. develop the 200,000 hp. through turbines which are (a) partly fixed and (b) partly adjustable blade





DOUBLE 115-kv. buses afford maximum flexibility in combinations and segregations to meet problematical character of load

avoided and the cost of switching kept to a minimum.

After much investigation as to the advantages of grounded versus ungrounded generator neutrals, decision was finally reached to leave the generator neutrals ungrounded in the usual sense. In lieu thereof, a 15-kv. potential transformer is connected between the floating neutral and ground. To the secondary of this potential transformer is connected a low-voltage relay which actuates the station alarm system. It is thus believed incipient grounds may be detected and the unit removed from service in many cases and the destruction of an arcing ground avoided.

Transformers comprise four 34,000-kva. (present) and one 11,350-kva., three-phase, 13.8/115-kv. unit delta-connected on low-tension side and solidly grounded wye on high-tension side and mounted on the draft tube deck. They are of the self-cooled, air-blast type with the fans under thermostatic control by winding temperature. This type of unit offers the lowest cost per kva., but higher losses than the self-cooled type. A study of the annual value of increased losses against the differential in investment showed their use to be justified. These units are moved to the dismantling bay by swiveling caster wheels and the use of transfer cars is avoided.

Control Boards

The main control board is in two parts, a circular bench board and, directly behind this, a combination relay and instrument board. Included on the latter is an automatic oscillograph which may be switched to any outgoing line. It is the authority's intention to employ this oscillograph extensively to gather information as to exact line characteristics better to facilitate relay adjustment. Included among the proposals is the plan to fault the lines phase to phase and phase to ground at different points and observe their behavior.

Two Leeds & Northrup load controllers are provided, arranged to be switched to any line, since it is not now determinable which lines will require them.

As an accessory of the annunciator system, three forms of alarm are provided, a siren to indicate release of CO_2 and instant loss of a unit, a bell to denote emergencies which must receive immediate attention, and a horn to denote emergencies in which some delay in attention is permissible; simultaneously a light is illuminated on top of the unit originating the alarm. It is thus hoped the floor attendant may be more quickly and surely apprised of the emergency with which he is confronted.

As a part of the annunciator, a printing recorder is provided which records the exact time and sequence of selected incoming annunciations. Thus when the operation of several relays causes an interruption the relay first to function is determinable and a clue to cause can be had.

Line relaying is by impedance and ground relays with provisions for the addition of carrier pilot.

A PBX telephone system provides communication throughout the plant with priority facilities for instant communication between control room and actuator cabinet.

The 250-volt main control battery is maintained by two diverter-pole charging sets.

To insure that the motor-driven recording instruments are provided with dependable power supply for chart motors, a small constant-speed inverter is provided which will on interruption of the normal supply start up from the battery to supply the deficiency.

Power Design in Defense Plants II—Primary Distribution

Modified radial distribution systems at 4 kv. and under are the rule — Double-bus systems, duplicate primary feeders and provision for looping primary buses assure reliability — Interconnected secondary mains and network lighting systems widely used

HERMAN WINTE, Albert Kahn Associated Architects and Engineers, Inc., Detroit, Mich.*

ONCE ESTABLISHED, the primary distribution system of a modern defense industrial plant determines its electrical future so far as simplicity of operation, expansion, rearrangement and ability to meet emergency conditions are concerned. Once fixed, it must be lived with. For new defense plants are vast and sprawling, and investment in primary cable between master and factory substations is large enough to discourage frequent change. Design decisions, then, must be made with care.

Of the many factors to be determined for each individual plant three are of particular importance.

1. *Voltage:* — Distances between master and factory substations and load magnitudes rule out voltages lower than 2,300 because of voltage drop and carrying capacities of cables. An upper limit of 13.2 kv., on the other hand, is adhered to as the highest that can be safely handled by maintenance personnel; 4 kv. is a popular voltage for medium-sized plants. Frequently distribution voltage is selected to correspond with local utility distribution voltage so that cable and other equipment can be readily exchanged in emergencies.

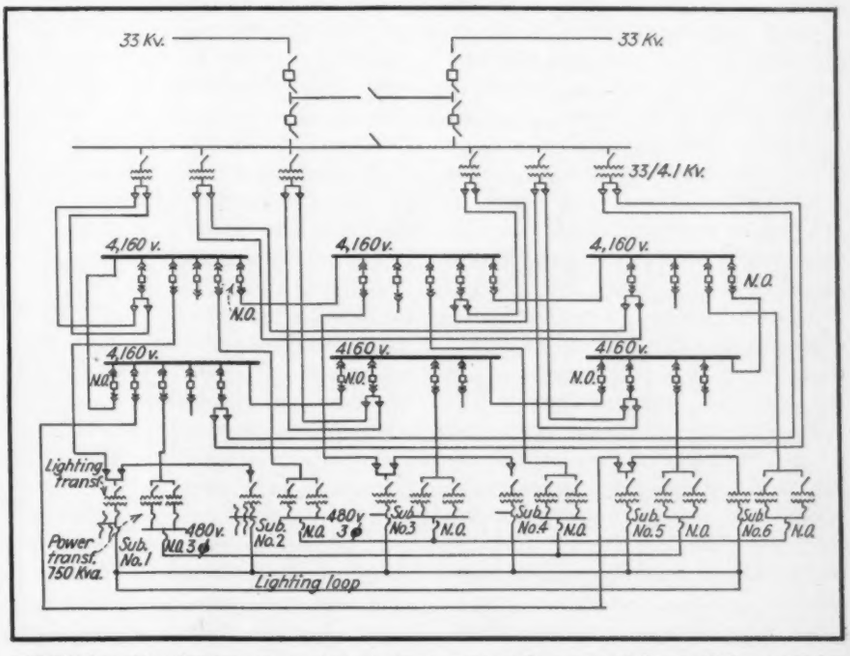
2. *Arrangement, Flexibility, Reliability:*—Loss of a single factory substation means a loss of from one-tenth to one-third of the plant load. The extent of duplication of feeders, looping of primaries, interconnection of secondaries for reliability therefore bulks large. The problem is largely one of judgment and economic balance between the cost of primary cable, the cost of secondary cable and the amount and type of switchgear required for a given system to gain flexibility.

3. *Degree of Complexity*—A system that is the ultimate in reliability frequently requires a degree of skill in operating personnel beyond justifiable economic limits for an industrial plant. Complex systems, while subject to fewer interruptions, are difficult to sectionalize in cases of trouble and just as hard to put back together afterward.

Radial Feed Preferred

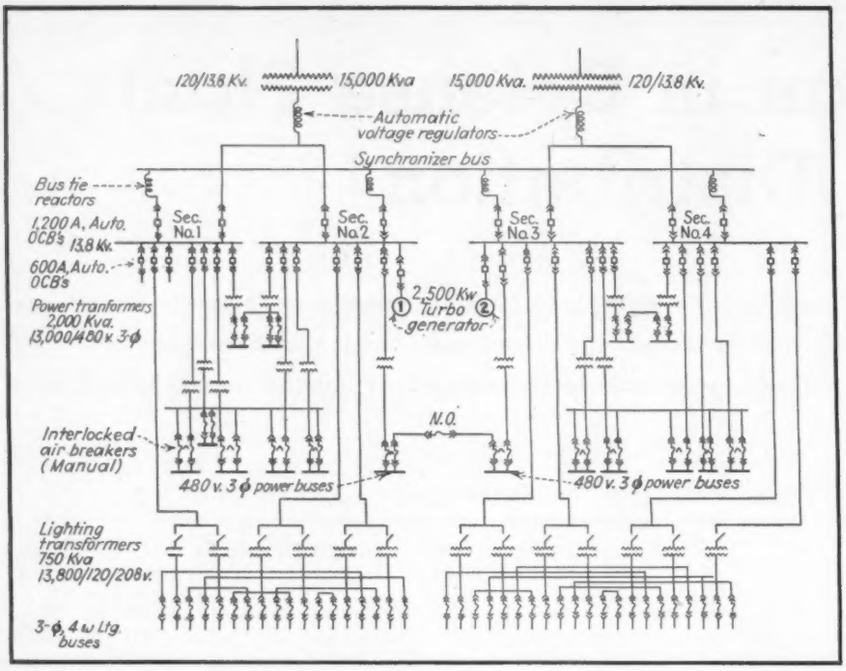
Defense plants, in the main, use modified radial distribution systems as (1) offering the greatest economy of copper and primary switchgear, (2) being simplest to operate in emergencies and (3) because the extensive use of two or more separate supply lines from different parts of the utility system prevents tying the two sources together in the plant.

Modification of the radial arrangement, usually dictated by reliability, generally consists of (1) providing two sources of supply for factory substation feeders, (2) a feeder to each substation from each high-tension bus at the master substation, (3) looping of factory substation buses ahead of power and lighting transformers, (4) interconnection of low-voltage secondary mains between factory substations or (5) a combination of the above.



SCHEME I—Distribution pattern for airplane engine plant was influenced by need for feeding power generated in engine test cells back into system

*Electrical engineer.



SCHEME II—This distribution system serves the largest plant in the world to be housed under one roof

Since lighting is considered a service of prime importance, particularly in blackout plants, lighting transformers have separate feeders and their secondaries are extensively interconnected. Network lighting systems are very common.

Typical Systems

Four actual defense plant distribution systems are illustrated in the accompanying schematic sketches. These schemes are not to be interpreted as model systems. They are systems that experience has shown to be highly satisfactory and therefore good engineering practice; preference of different firms, based on their operations and the pattern of electrical layout to which they are accustomed, influence electrical design in any plant. Each, however, has features worth considering for different situations.

Scheme I—Main 33-kv. bus at the master substation of an airplane engine plant is in two sections served by individual overhead lines. Three power transformer banks connected to each bus section through disconnect switches (breakers may be added later) step voltage down to 4,160. Each bank supplies alternate individual 4,160-volt buses (of which there are six *located at the master substation*) through an automatic transformer breaker. The six 4,160-volt bus sections are normally operated separately, but can be joined through normally open bus-tie breakers, to permit any bus section to be energized from adjacent sections in emergency. Since adjacent bus sections are connected to separately fed 33-kv. buses, interlocks are provided between the transformer breaker and the two tie breakers connecting any section with those adjacent.

Generators driven by airplane engines on test at this plant are connected in groups to these 4,160-volt buses through individual breakers. Output of the 40-odd test generators is pumped back into the plant and utility supply system and is the principal reason for this bus arrangement. Details of this engine-test set-up will be discussed in another article.

The power transformers in each factory substation in this plant are individually supplied from the 4,160-volt buses by a *single* cable through an automatic feeder breaker. Secondaries of power transformers associated with the same 33-kv. main bus are tied together through normally open non-automatic tie air breakers in the secondary power switchboard at each factory substation. Thus the load of any substation can be served from the other related substations through the secondary interconnection. Each factory substation has a lighting transformer bank and each lighting feeder serves two such banks.

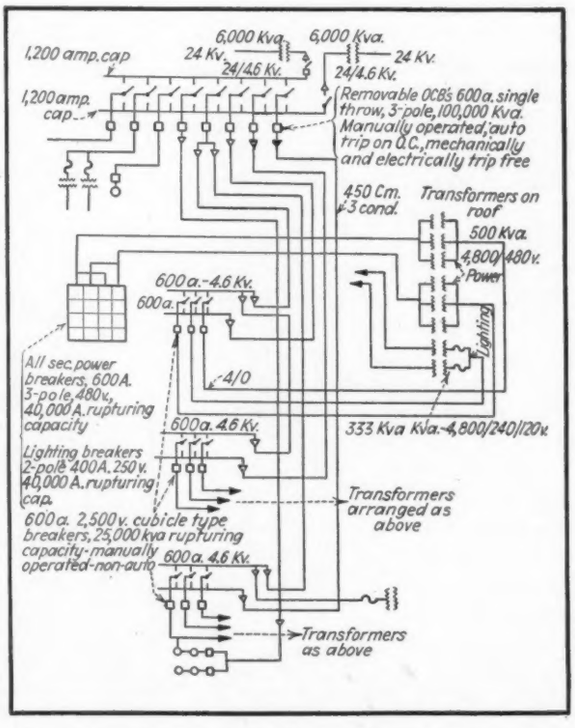
Merits of Scheme I are several:

1. There is only one primary switching point in the plant. From it supply and interconnection of the 33-kv. and 4,160-volt buses can be controlled and any group of engine test cells isolated from the system in the event of bus fault or changes in plant load conditions.

2. This is probably the most reliable arrangement for a given plant investment. Increased service continuity could only be had by adding switchgear at the factory substation to effect alternate primary supplies.

3. Provision for interconnecting the 4,160-volt buses through interlocked tie breakers assures against loss of load due to complete failure of bus section feeder cables, potheads or transformer bank.

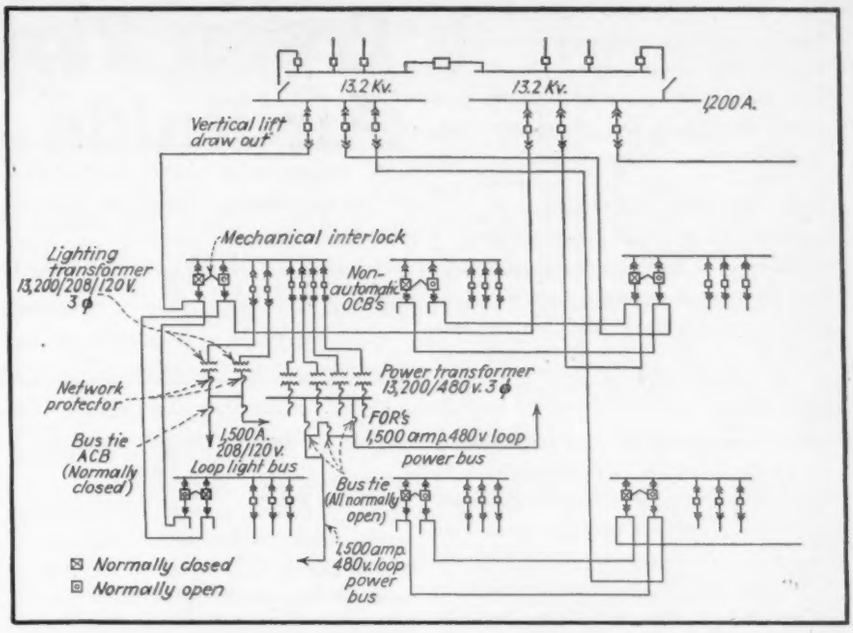
4. Single radial 4,160-volt feeder to factory substations, relying on 480-volt interconnection for serving


1,200 amp. cap
6,000 Kva.
24 Kv.
24/4.6 Kv.
6,000 Kva.
24 Kv.
24/4.6 Kv.
1,200 amp. cap
Removable OCB's 600 a. single throw, 3-pole, 100,000 Kva. Manually operated, auto trip on O.C., mechanically and electrically trip free
450 Cm. 3 cond.
Transformers on roof
500 Kva.
4,800/480 v.
Power
Lighting
600 a.-4.6 Kv.
600 a.
4/0
All sec. power breakers, 600 A. 3-pole, 480 v., 40,000 A. rupturing capacity
600 a. 4.6 Kv.
333 Kva Kva.-4,800/240/120 v.
Lighting breakers 2-pole 400 A. 250 v. 40,000 A. rupturing cap.
Transformers arranged as above
600 a. 2,500 v. cubicle type breakers, 25,000 kva rupturing capacity-manually operated-non-auto
600 a. 4.6 Kv.
Transformers as above

SCHEME III—Use of a double-bus system in both master and factory substations is an important feature of this system used at an arsenal

substation load in event of feeder, pothead or breaker failure, resulted in copper economy and simplified the system without sacrifice to reliability.

Scheme II—Used in a bomber plant of 62 acres area under one roof this arrangement achieves simplicity and economy of distribution through a flexible, but expensive, synchronizer bus and switching system at the master substation. Like the airplane engine plant of scheme I it had generating capacity within its electrical system, which influenced design. Also like Scheme I the plant was scattered over a vast area. The large number of factory substations (more than twelve) dictated a simple radial distribution system to keep cable investment down. However, limited looping of factory substation secondaries—associated with the same high-tension supply line—provided inexpensive reliability, while a network lighting system insured continuity of this essential service.



SCHEME IV—High degree of flexibility and reliability marks the primary distribution system supplying factory substations at a defense plant. Duplicate feeders to each factory substation and interconnection of lighting and power buses are features

Normal power supply to this plant is over two 120-kv. lines. Each supplies two of four separate 13.8-kv. bus sections. Two 2,500-kw. turbo-generators are connected to two of these four 13.8-kv. buses. All four 13.8-kv. bus sections—or any combination of them—may be tied to a synchronizing bus through normally open automatic, metal-clad vertical lift switchgear and series reactors. Thus the utility lines and the generators can be synchronized or the plant can be supplied from either utility line in parallel with the plant turbines.

Protection Against Paralleling

Reactance in series with bus tie breakers reduces interrupting capacity required for breakers in event both utility lines are simultaneously paralleled. Interrupting rating of breakers is established at a little over the short-circuit kva. that the two main transformer banks in parallel can push through the system.

Distribution to factory substations is radial. The 480-volt, three-phase secondaries of power transformer banks associated with the *same* high-tension bus are interconnected through interlocked normally open tie air circuit breakers. Interlocks prevent tying together two factory substations fed from different utility high lines. Distribution is at 13.8 kv., since this is a standard voltage for the rest of this company's plants.

Plant lighting is supplied by a number of 750-kva., 13.8-kv., 120/208-volt lighting transformers supplied in pairs by radial feeders from the four 13.8-kv. bus sections. Lighting bus sections are networked with network protectors at transformers.

Scheme III—Used in an arsenal, has a high degree of primary switching flexibility. A double bus and selector disconnect switch arrangement in both master substations and factory substations provides two sources of supply to each factory substation feeder and in the factory substation permits both lighting and power load to be fed from either of two 4,600-volt primary buses. Normally, one factory substation bus supplies lighting load, the other power. Because of its flexibility it was not deemed necessary in this system to interconnect the 480-volt secondary system.

The two main buses in the arsenal's master substation are supplied from individual 24-kv. lines through separate 24,000/4,800-volt transformer banks. Double-throw disconnect switch permits each radial feeder to be connected to either main supply bus. An automatic oil circuit breaker in each feeder is the principal short-circuit protection.

Individual feeders from the main arsenal substation supply the power bus in each factory substation. The lighting buses of all factory substations are served from a single feeder breaker at the master substation.

Transformer feeder breakers of factory substations are non-automatic, manually operated, oil-filled switches for reasons of economy. Full reliance is placed on the automatic feeder oil circuit breakers at the master substation for protection.

Major merit of this system is the reliability secured by provision of two supply sources for all important feeders. The ultimate in reliability could be secured by secondary looping if desired. This would increase cost of an installation which already requires considerable investment for buses and double-throw disconnect switches used. Investment in cables compared to that for a straight radial system is somewhat high, but over-all cable investment compares favorably with schemes using elaborate secondary interconnection.

An Alternative

Alternate to the use of double-throw disconnect switches would be draw-out type circuit breakers arranged back to back with two compartments—one for each bus—for each breaker. If one bus failed the breaker could be removed and placed in the vacant compartment and connected to the other bus. This, however, would increase cost considerably.

Scheme IV—Used by an airplane engine plant is the exception to the general rule that parallel operation of high-tension supply lines is avoided.

Here the relatively low supply volt-

age (13.2 kv.) made parallel operation of cables mandatory in order to secure the necessary capacity. As load within the plant grows it is proposed to supply the plant over two separate 66-kv. lines and transform to a lower voltage for distribution within the plant. At present the two sets of two 13.2-kv. lines come in a utility-controlled sectionalized bus that feeds two separate factory main buses. From these, 13.2-kv. feeders radiate to the various substations in the plant without voltage transformation.

Duplicate 13.2-kv. feed is provided for each of the factory substations at this airplane engine plant through an interlocked breaker arrangement. The 13.2-kv. feeder cables protected by automatic oil circuit breakers are each connected to two different factory substation buses. Each feeder normally supplies but one of the two buses to which it is connected. Each of the two feeders to each factory substation bus is from a separate 13.2-kv. master substation bus, so that if trouble develops on either main bus feed will be available to all substations from the remaining one.

Non-Automatic Breakers

Power and lighting transformers at each factory substation tap the substation bus through low-cost, non-automatic oil circuit breakers. Secondaries of the power transformers are connected to a 480-volt power bus which is tied in to a 1,500-amp. capacity, 480-volt loop connecting it with the other factory substations. The breakers connecting each 480-volt bus to the power loop are arranged so that individual substations may be completely by-passed if desired, made part of the loop or operated in groups of two or more, depending on conditions. The substation lighting buses are similarly looped.

Advantage in the use of duplicate supply breakers in factory substation buses is that the normally open breaker can be substituted for the normally closed breaker in case of breaker equipment fault — avoiding extended shutdown. There is but one source of supply for each factory substation feeder; however, the duplicate feeder to each factory substation bus from the other master substation bus and looping of secondaries more than overcomes this, but at the expense of somewhat higher investment.

Power Plants vs. Air Raids

British find multiplicity of small practices in power plants most helpful in averting the consequences of and recovering from air raids

BRITISH UTILITIES have learned that protection of equipment in and of service from a power plant during wartime depends on a multiplicity of relatively small measures. In a recent article in *Electrical Review* G. V. Harrap enumerates some of these lessons and the excerpts below should prove of interest to those giving thought to initiating precautionary measures in areas perhaps exposed to air raids:

Experience gained during the past twelve months shows that generating units have withstood bomb splinters and blast remarkably well owing to the sturdy construction of turbine casings and alternator stators, and that a bomb need not be very far away for it to fail in destructive effect. Many undertakings have installed a roofing of sheet-steel over the valve gear, which has proved its value, and fires from lubricating systems have not been the worry that was anticipated. Some machines have been incased in brickwork and concrete and this has been valuable. Heating troubles have not taken place, except around the high-pressure end of the turbine, where additional ventilation has been necessary.

In the boiler house automatic control systems have been well able to handle the fluctuating load conditions prevalent in times of persistent air raids.

Stores should be dispersed, since their destruction can be exceedingly serious. Steam jointing material, lagging, grate links, high-tensile bolts, etc., are in constant need and a hold-up in supplies may have serious consequences.

In the control room fire protection of cables has already been carried out in most undertakings, but the main trouble has been found to be in damage to the control wiring and cables. It is so essential to reconnect absolutely correctly and the space available is often so limited that it can be quite a long job to reobtain remote operation and indication of equipment after damage.

Exposed Equipment

Many items of auxiliary apparatus stand out in the open. As protection from blast, walls made from hollow concrete or breeze blocks, cemented horizontally and filled with sand, have been found most successful. A cheaply constructed sloping corrugated-iron roof deflects a certain amount of the lighter debris, though it needs something more substantial to stop the incendiaries, bricks and lumps of stone which often fly about in air raids.

To provide a more complete protection the walls, which must not be less than 14 in. of brickwork or 18 in. of breeze blocks, should be built a little higher than the gear to be protected. A flat concrete roof should then be put over the area, resting on piers built up from the walls, and maybe with supporting stanchions inside the area covered, with a space between the top of the wall and the underside of the roof of about 12 in. This space can be covered with a heavy-gauge expanded metal sheeting so as to give ventilation.

Bombing of the distribution network has an effect in the power station, because any cable fault between the switch-house and the first substation supplied by the feeder will operate the main station switchgear. This will mean an increase in maintenance and calls for good liaison work between the generation and distribution staffs. These increased operations will mean increased duty on the tripping and closing batteries and therefore necessitate more frequent charging and overhaul.

PRIORITIES

This Supplement presents the salient facts regarding the procedures open to utilities and their suppliers for obtaining aid in getting materials required for essential operation and expansion of electric power service to meet war needs. It is not an attempt to appraise the priorities system.

There are five categories of priorities instruments: "P" Series orders provide limited blanket ratings to specified groups to acquire designated materials. "M" Series orders (and the few "E" Series orders relating to tools and equipment) set up controls over distribution of particular commodities, the instruments for allocating and rationing materials and commodities. "L" Series orders restrict production of designated articles. The "S" Series order (so far only a few have been issued) is a disciplinary measure. In addition there is the PD-1 form, a "jack-of-all-trades" instrument for obtaining assistance on specific orders for which other procedures either are not available or not adequate.—EDITORS.

PD-1

OPM ORDER: *Basic priority instrument.*

AVAILABILITY: *Small construction; to augment Project Ratings; situations not remedial by other means.*

RATING: *As assigned, on supplier; not extendable.*

APPLY: *OPM Priorities Division. "Attention: Power Branch."*

FORM USED: *PD-1.*

The PD-1 form was the first, and is the primary means of applying for priority assistance covering a specific situation where other procedures are not available or will not do the job.

In the priorities framework for utilities, the PD-1 serves two principal functions. One is to obtain a rating for critical items needed for a small construction job (too big for P-46, but not big enough for a Project Rating). The other is for obtaining a higher rating for a really critical item for a rated project.

In filing PD-1 applications with OPM, the most important thing is to keep in mind the position of the man who is going to grade it—he's swamped with other applications and he doesn't know much about any property. Therefore, the application should be clear, concise and complete —and in the *first* application. A follow-up has little chance of catching up with the original.

The three basic questions to answer in a PD-1 application are: Who are you, what you want, who is to supply it. Identify the "what" by giving both the price and the quantities of scarce materials necessary if you can; either price or quantity must be supplied.

In addition, it is necessary to explain why you need the materials sought, when you need them in terms of your operations, as well as when your supplier can provide them. To support the first of these, it is wise to attach to the PD-1 form a short (not over a half page) statement in your own words. To emphasize the dates, it is a good idea not only to list when delivery is promised but what rating it takes to get delivery by that time, after consulting with the supplier.

If several PD-1's are involved in a single undertaking, tell the whole story to OPM on each one, attaching a copy of your own statement to each application. It's best to use a staple rather than a paper clip, so that the sheets will not become separated.

Ratings granted on PD-1 applications are issued in favor of the supplier and are not extendable. Suppliers who must obtain materials to fill a rated order must, in turn, file a PD-1 if they have no other avenue of priorities available. Suppliers' PD-1's should identify the rated order for which the material is needed.

It is permissible to include several items ordered from the same supplier in one PD-1 application, but care should be taken to include only materials of equal urgency. In other words, don't apply for a rating in one application for copper wire for an industrial feeder line and some insulators for the residential distribution area. A single application must be given a single rating, so inclusion of unequal materials of urgency will result either in the application being sent back or an inadequate rating upon the important items.

While several items purchased from the same supplier may be included in one application, a separate PD-1 form must be used for each supplier involved. There has been considerable effort made to put into effect some sort of multiple PD-1 form which could include materials from several suppliers for a single job, but this has not been done. Until it is, be sure to apply separately for each supplier.

Another important rule is to fill out each section of the PD-1 form even though the answers to some parts of it are covered in the separate statement.

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Q—Must I place an order with my supplier before filing a PD-1 application?

A—This is the usual procedure, but is not required. Sometimes it is worth finding out first whether you can get a rating.

Q—Is there any limit to the value of materials which can be obtained on a PD-1?

A—No.

Q—Should I send my PD-1's to the Priorities Division or to the Power Branch?

A—Best method is to address OPM Priorities Division, "Attention Power Branch." All PD-1's are segregated and indexed, then routed to the proper OPM branch for grading. Marking your application for Power Branch attention should insure its being sent there.

P-46

Repair and Maintenance and Inventory Controls

OPM ORDER: *P-46.*

AVAILABILITY: *To obtain materials for continuous operation; subject to specific inventory and use limits.*

RATING: *A-10.*

APPLY: *By utility, to orders on suppliers, who may extend.*

FORM USED: *Self-indorsement.*

Priorities Order P-46 is the basic instrument of this war period for utilities. It is essential to realize that this order has two distinct functions and purposes.

One gives to utilities a means for obtaining those materials necessary to maintain continuous service. The other rigidly restricts permissible receipts, uses and stocks which may be kept on hand of all critical materials. By Amendment No. 3 to P-46, issued December 11, 1941, all utilities are blanketed under these latter restrictive provisions, whether or not they have been, or are now, using the avenue provided for obtaining supplies.

For the first function of P-46 an A-10 rating is provided. This rating is self-assigned by the utility in placing orders eligible for this type of priority aid. The legend *"Purchase Order for Utilities Operation, Maintenance and Repair, Preference Rating A-10, pursuant to Preference Rating Order No. P-46"* must be stamped on each copy of such orders, but this statement need not be signed by a company official; the purchase order or requisition signature is sufficient indorsement to validate the rating.

All A-10 ratings applied by utilities to orders upon their suppliers are fully extendable by the suppliers to obtain necessary component materials. Suppliers must stamp on each copy of all orders they place to fulfill P-46 rated orders the same legend that is applied by the utility initially.

The A-10 rating may be used, subject to the restrictive features of the order, to purchase:

Materials for normal repair and maintenance of property in sound operating condition.

Supplies necessary for conducting operations.

Materials to connect new customers to existing distribution systems and to make minor capital improvements costing not more than $500 ($1,500 in case of underground extensions).

Additional materials for use in power houses proportionate to the expansion of operations over previous quarterly periods.

Within the restrictions set up over receipt, use and inventory of materials, there is no size nor dollar limitation upon the repair or maintenance job to which the A-10 rating may be applied. Any facility which would normally be replaced to keep the property in good repair and sound operating condition may be replaced.

Restrictions

The restrictive provisions of Order P-46 are considerably more complex than its permissive features.

Most important is the fact that all restrictions upon the purchase, use or inventory of materials is tied to dollar values, which means that increases in prices reflect in direct ratio in decreases in the volume of physical materials available to a company.

The order provides that no utility shall, during any calendar quarterly period:

1. Accept deliveries of materials for use for repair and maintenance or as operating supplies in excess of 25 percent of the dollar volume of deliveries of materials of the same class during all of 1940, or, at the company's option, during the corresponding 1940 quarter.

2. Withdraw from inventories for use for repair and maintenance or as operating supplies materials in excess of 25 percent of the dollar value of materials of the same class withdrawn for these purposes in all of 1940, or, at the company's option, during the corresponding 1940 quarter.

3. Maintain inventories of materials for repair and maintenance or of operating supplies in excess of the dollar value of materials in the same class which were in inventory of December 31, 1940, or, at the company's option, at the close of the fiscal year ending in 1940. The order prohibits acceptance of any deliveries until inventory has been reduced to this prescribed level.

In all of these limitation provisions only those materials normally carried for repair and maintenance or as operating supplies are included. In other words, the 1940 "par" figures for receipts, withdrawals and stores include only materials charged to these categories for repair and maintenance or as operating supplies.

Furthermore, Form PD-194A, the P-46 report form, sets up five "control" sub-classifications of the total "par" inventory and withdrawals, and utilities are required, in each quarterly period, to stay within the 1940 dollar value for each of these "control items." For instance, the report form calls for data on 1940 and 1941 expenditures for generating station repair parts (electrical), repair parts (other than electrical), chemical materials and supplies, and other materials and supplies. The total of these classes, listed on the form as "Total generating station materials and supplies (other than fuel)" is one "control item."

These "control" classes, however, are intended to be reasonably broad, to permit considerable flexibility in repair and maintenance activities from period to period.

Meters, by Amendment No. 2, issued November 25, 1940, are under a separate form of control. This provision stipulates that utilities may accept deliveries and withdraw from stores sufficient meters in any quarterly period to serve net new customers plus 25 percent of the meters destroyed in all of 1940. The control here is not pegged to dollar values.

In addition to the controls heretofore described, Amendment No. 3 imposes the additional restriction that no materials of any kind may be withdrawn from total inventory for additions to or expansion of property without prior approval of OPM. Exceptions are projects which were 40 percent or more complete on December 5, 1941, or which cost less

than $500 ($1,500 in case of underground extensions), but in no case may new line extensions exceed 1,000 feet without prior OPM approval.

This "freezes" utility inventories of all kinds not segregated for specifically rated construction which were in stock on December 5. Materials in stock for projects 40 percent or more complete, or for minor improvements, as defined, may still be withdrawn if such withdrawals can be made within the quarterly quotas. A special procedure is being worked out by OPM to permit a utility to draw upon its own inventory for approved construction.

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Q—In replacing switchgear under P-46 as a maintenance job, may there be any net improvement to my property?

A—The Power Branch interprets the order as permitting up to $500 improvement over the original cost of the replaced facility. Thus, your switchgear can cost $500 more than the old.

Q—What is included in the $500 cost of minor improvements for which P-46 may be applied?

A—The $500 should cover only the cost of materials. Installation labor is not part of the cost.

Q—I have not been using P-46 to get materials. Must I now file an acceptance with OPM to begin applying A-10 ratings to my orders?

A—No. Amendment No. 3 blanketing all utilities under the order eliminated the acceptance requirement, but it is still desirable that you notify OPM of your intention to apply A-10 ratings.

Q—Are my fuel purchases limited to the 1940 dollar value?

A—Amendment No. 2 specifically exempts fuel, water purification chemicals, wooden poles and wooden crossarms from all purchase, use and inventory controls.

Q—What provision is made by OPM for unusual situations requiring me to exceed the limits on use of repair materials?

A—Sections F-4(iv) and (v) of Amendment No. 2 provide that, to meet unavoidable situations, you may exceed quarterly limits by 2 percent, and, to repair damage caused by fire, flood, "or other climatic conditions," you may exceed restrictions to whatever extent is necessary. In the latter case you must make up the excess in the following two quarters unless OPM authorizes otherwise.

Q—Does the ban on construction in Amendment No. 3 affect my inventory or use of materials for projects which have PD-1 or Project Ratings?

A—No. Materials for a rated project are not covered by this amendment, whether they are in stock or not.

Q—Amendment No. 2 permits increases in inventory and use of materials for repair and maintenance proportionate to increased business. Does this apply to all system operations?

A—The increases provided in Section F-4(i) and (ii) of Amendment No. 2 apply only to repair and maintenance and operating supplies for your power house. You cannot increase inventories for maintenance work on substations or lines or anything beyond power houses.

Q—Isn't the effect of tying inventory and use of materials for repair and maintenance to 1940 dollar levels one of reducing permissible maintenance?

A—The order definitely does have that effect.

Q—In 1940 my company built an unusual amount of line extension, making our withdrawals of materials higher than normal. Does P-46 prohibit us from counting this extension work in calculating the amount of materials we can use now?

A—The order stipulates that your "par" withdrawals are limited to the materials used in the functions provided for in the order—maintenance, operation and repair, plus connection of new customers and minor improvements. You may not include withdrawals for other purposes in 1940 in your base.

Q—The blower on my fire box is old and I would rather replace than repair it. May I use the P-46 rating to get a new one?

A—Yes, if the new one doesn't cost more than $500 more than the old.

Q—Is it OPM's intention that the data supplied for sub-classifications in Form PD-194A shall be of accounting accuracy?

A—Not necessarily. The "control items" (marked by asterisks on the form) adapt themselves to the commonly used classification of accounts and should be accurately reported. Data for the sub-classifications, it is expected, will be based upon careful estimates. A good idea would be to footnote an explanation of how the data were computed, in accordance with instruction "H" on the form.

Aid to Suppliers: P-100

Repair and maintenance priority aid for manufacturers and suppliers, in utility and other fields, is now obtained through P-100, which replaced P-22 on December 18, 1941. In general, administrative and materials control features of the two orders are similar, differences being to cover different operating requirements.

One administrative and one restrictive variation is outstanding. In assigning A-10 ratings under P-100, the purchaser uses this indorsement: "*Material for Maintenance, Repair, or Operating Supplies—Rating A-10 under Preference Rating Order P-100 with the terms of which I am familiar,*" which must be signed, in addition to the purchase order signature. And the control section permits withdrawals and inventories up to 110 percent of dollar values of the comparable 1940 quarter, or up to 27½ percent of total 1940 withdrawals and inventories.

Other important changes from P-22 in P-100 include:

Operating supplies include such items as nails, etc., but non-ferrous metals are restricted. Fuel is exempted from inventory controls. You may apply the rating whether or not you can get the materials without it. Suppliers may group several orders for such items as conductor connectors (upon which no physical change is made) so as to purchase in minimum commercial quantities.

Emergency Breakdown

OPM ORDER: *No formal order.*

AVAILABILITY: *Repairs for operating breakdown.*

RATING: *As assigned, by OPM on supplier.*

APPLY: *Telephone or telegraph, to J. A. Krug, chief OPM Power Branch.*

FORM USED: *No prepared form.*

OPM's Power Branch is set up to grant a priority rating within 24 hours for materials necessary to repair emergency breakdown of essential utility operations. The entire procedure can be, and usually is, carried out by telegraph and telephone.

Specifically, the emergency breakdown procedure is available where Priorities Order P-46 (see page 40) is inadequate, and the PD-1 procedure (see page 39) is too slow, to obtain materials for repairs necessitated by a forced outage of any kind of equipment essential to continuity of service, and to repairs discovered to be necessary during a periodic inspection or overhaul.

The utility in trouble may telephone or telegraph the Power Branch for help, but where the telephone is used confirmation by wire or letter must follow to provide a permanent record of the case. The Power Branch priorities staff may make a phone check with the supplier involved, then transmit telegraphic assignment of a rating directly to the supplier, to be followed later by a formal priorities certificate by mail. A copy of this confirmation also goes to the utility.

This emergency breakdown priorities procedure is not grounded in a formalized OPM order, but it gets its roots from P-46. Therefore, emergency assistance of this sort can be extended only in instances where the A-10 rating available under P-46 is not adequate.

It is essential, therefore, that any applicant for emergency assistance shall have first extended the P-46 rating to the supplier before contacting the Power Branch. This procedure is intended to be utilized only in cases of real emergency not remedial by any other means.

When applying for aid, most important insurance for getting prompt assistance is to provide properly detailed information in the first telegram. There are no specific OPM forms provided for application, but this is the minimum data required:

> What has happened, and what does the breakdown mean in terms of the company's operations.
>
> What has been done to get the break repaired by using P-46 or other means.
>
> Dollar value of repair parts involved.
>
> Order number upon supplier and identification of what it calls for.

A separate application must be made for each order and each supplier involved, even for the same breakdown. Different ratings may be granted for different orders, but the intention is that the ratings will be geared to get the material to repair the breakdown at the earliest time consistent with the importance of getting the interruption repaired. Relative importance is judged by the effect upon operations, as well as how vital are the facilities which are out of service.

Any rating, from the highest on down, can be applied to remedy an emergency condition. It is not necessary always to ask for an A-1-a rating, however; better procedure is to ascertain from the supplier what rating is essential to meet the delivery requirements and then include this information in the telegram of application to Washington.

Power Chief J. A. Krug has intentionally maintained this emergency procedure as a flexible, informal one rather than a specific routine, so that it can be tailored to fit the need in cases of real emergency. In this, the utility priority system is different from that set up in Priorities Order P-56, the P-46 counterpart for mining operations, where such situations have been made an integral part of the order and all such cases carry a predetermined rating.

PRIORITIES REGULATION NO. 1

Basic document of the entire priorities system is Priorities Regulation No. 1, issued last August and amended December 23, 1941. This regulation is incorporated by reference into every priority order, making knowledge of its provisions essential to anyone using or operating under any priorities procedure.

Priorities Regulation No. 1 applies in all respects except where its provisions conflict with specific directions in a particular order, in which event the individual order prevails. An example is Section F of P-46. Regulation No. 1 provides broadly that inventories may not be increased beyond a "practical working minimum." The P-46 section spells out specifically the volume of materials which may be procured, used and stocked (see page 40).

Terms of the regulation require acceptance of all defense orders, whether or not they carry specific ratings, and, by the December amendment, require acceptance also of all "B" (non-defense) rated orders. Exceptions are limited to cases when deliveries would conflict with previously accepted orders with equal or higher ratings, when purchasers fail to meet regularly established prices and terms, when material sought is not customarily produced, and when delivery would force termination of a production schedule already commenced. The December amendment also permits refusal of an order if delivery can be made only with material completed or nearly so for a previously accepted lower rated order.

Detailed definitions of the terms "defense order" and "material," applicable to the entire priorities system, are contained in the regulation. Also set up are provisions for appeals by customers whose orders have been rejected and by those upon whom priorities orders work especial hardship. Other provisions permit the Director of Priorities to allocate raw materials without regard to preference ratings, require that production schedules be so arranged as to meet delivery dates on defense orders, relieve concerns from non-fulfillment claims resulting from priorities actions, and cover various procedural matters.

Project Ratings

OPM ORDER: *P-19a (Material for Defense Projects).*

AVAILABILITY: *Construction costing over $2,500, involving 10 or more suppliers.*

RATING: *As assigned, to utility.*

APPLICATION: *To J. A. Krug, chief, OPM Power Branch.*

FORM REQUIRED: *No prepared form at present; detailed analysis and supporting data showing need is required.*

All new major construction by utilities now requires a project rating from OPM. Exceptions are short line extensions and minor capital improvements permitted under Priority Order P-46 (see page 40) and small jobs costing less than $2,500 or involving less than ten suppliers, which are handled with PD-1 applications (see page 39).

Most important in applying for a Project Rating is to show the tie-in the project has to requirements for the war program and its urgency. For this more than just a statement must be given; the tie-in must be quantitative, supported by exhibits.

A single priority rating is supplied for each complete project. The Power Branch weighs the necessity of the job to meet direct or indirect war requirements or essential civilian needs which cannot be curtailed, the relative magnitude and importance of war activities involved, and the date of completion. Date of completion is important, projects scheduled three or four years ahead will likely get lower ratings than more immediate projects of the same apparent urgency. In general, the ratings for essential projects are designed to obtain the bulk of materials involved at the time they are required.

Project ratings are issued to utilities, and can be used to obtain all materials required for the project which are on the critical list. Ratings are fully extendable to suppliers and sub-suppliers down to the component raw materials. Increasing use of allocation for raw materials for specific end product uses may modify this at the bottom of the industrial ladder, but it is expected that priority certificates still will be used as a means of checking withdrawals (see page 44).

In assigning a Project Rating, the Power Branch may require some substitutions of materials. The way to get speedier action is to eliminate the "trimmings" from the project before submitting an application. If the plan requires extensive redesign because of excessive demand for scarce materials, the application will be returned; if specifications call only for minor tailoring, a rating subject to limitations may be issued.

An application should be the sworn statement of an executive officer, prepared on 8½x11-in. paper and bound in a folder. Send two copies. Full instructions for preparing an application appear in the next column.

Project ratings are available to all types of necessary construction and OPM is preparing a standardized application form which may soon be substituted for the informal presentation described here. It is probable that if this form is adopted, a modification will be worked out for utility projects incorporating, generally, the procedure outlined here. For the present, however, use the method of application herein described.

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Q. If a Project Rating isn't high enough to get a certain material, what does one do?

A. Apply for a higher rating for that item on a PD-1 form. (see p. 39).

Q. Can one get a Project Rating for work not having direct tie-up with war or essential civilian needs?

A. Power Branch may give a "B" (non-defense) rating, which means it can be constructed when materials over and above war needs are available.

Q. What should be included in a single project?

A. Include all elements necessary to effective use of the project. For instance, for a transmission line include switching equipment and transformers, appurtenances and accessories.

INSTRUCTIONS

As a guide, the Power Branch has issued instructions outlining information required to substantiate a project application. Here is what to include:

1 Name of operating company.

2 Location of project.

3 Clear, short statement of project's scope and relation to any existing or proposed construction. Include a map showing project relation to existing facilities.

4 Comprehensive statement of project's functional purpose.

5 Statement of project's relation to war, with supporting data, including a tabulation of volume, type and summary of major war loads. Fully identify customers and their war operations.

6 Statement of the urgency of need for the proposed construction, including estimate of existing and scheduled dependable capacities, reserve and net assured capacities, and requirements for the next three years.

7 If interconnections with neighboring utilities exist, or are possible, state extent and capacity to which they are or could be utilized, and extent to which they could make available to others any capacity of applicant's system. If interconnections exist and are not used, state why.

8 Latest practicable date for putting project into service.

9 Statement of aggregate dollars cost of the project. If project is under construction, state remaining dollar cost. *In both cases labor cost is excluded.*

10 Schedule of the larger elements entering into the project. For each element list expected sources of procurement, latest practical delivery date, estimated dollars cost exclusive of installation labor. Aggregate dollars involved should approximate 80 per cent of total dollars involved. Don't schedule deliveries of individual elements ahead of actual need.

11 Careful estimate of total weight of the critical materials involved—copper, steel, cast iron, aluminum, etc.

P-90

For Manufacturers and Suppliers—

OPM ORDER: *P-90.*

AVAILABILITY: *To manufacturers, for obtaining steady flow of materials for essential production.*

RATING: *As assigned, one or more granted in advance covering three months' operations.*

APPLY: *Production Requirements Branch, OPM Priorities Division.*

FORM USED: *PD-25A (Suppliers use PD-25C and PD-25D).*

The Production Requirements Plan is designed to provide a "one-stop" priorities service for manufacturers of essential products whose varied operations bring them under a number of different priorities procedures. Popularly referred to as PURP, this plan was put into operation with the New Year.

Essentially, it is a procedure for providing manufacturers with one, or more, limited blanket priorities ratings which can be used continuously over three-month periods to obtain a steady flow of raw materials for war and essential civilian production. These three-month periods, for all users, coincide with the calendar quarters—first ratings now in effect being for the January-March period.

PURP is a broad-scale enlargement upon the Defense Supplies Rating Plan, which it replaces. Where DSRP was limited, generally, to manufacturers of "off-the-shelf" type defense supplies, the successor plan is available to all manufacturers who can show that a substantial proportion of their output has been, and is, essential to the defense program or to the health and safety of the nation.

The plan eliminates a large proportion of the paper work heretofore necessary in getting priority aid to obtain raw materials and working supplies. With a PURP rating, or ratings, manufacturers are expected to be able largely to dispense with PD-1 forms. Neither do they have to extend individual ratings attached to orders on their books.

First step toward operating under PURP is to file for a rating on Form PD-25A. This form probes in great detail into your operations; it is essential that the data supplied be carefully broken down to answer thoroughly the questions posed.

In broad categories data required include:

Dollar volume of classes of products manufactured during specified periods.

Inventories of raw materials, work in process, finished goods and supplies on specified dates.

Dollar value of shipments on each priorities classification and to the Army, Navy, government agencies, lend-lease, and supplies; shipments for non-defense.

Itemized accounting for a long list of specified materials on hand, used in a specified quarter and estimated as required for the quarter for which rating is sought.

OPM considers, in determining ratings to be assigned, both the priority classifications on shipments and use to which they are put. This is a double check, and permits assignment of ratings, in some instances, to manufacturers of products which are being put to important uses but which may not have high ratings—hacksaws for cutting metals, for instance.

Today PURP ratings are assigned on a company basis. As rapidly as the detailed information required in the application forms gives OPM a picture of over-all industry requirements, it is intended to put this program on an industry basis.

•

Q—My business is such that I must make long-term commitments and need to assure my supply of materials longer than three-months in advance. Can I do this?

A—Yes, by filing separate PD-25A applications for each quarter. One turbine manufacturer has filed PD-25A's for all four quarters of 1942.

Q—Can I obtain machine tools or new equipment with my PURP rating?

A—No, capital equipment must be obtained by other priority procedures.

Q—If my anticipated requirements change during a quarter, can I get my rating changed?

A—Yes, by filing an interim report outlining why your rating is no longer adequate.

Q—May I use other priority ratings in addition to PURP ratings, for some production materials or for repair and maintenance?

A—Not without special OPM permission. If you accept the PURP plan, you must use the ratings you get in buying all production materials, or maintenance, repair and operating supplies covering your essential output. This includes purchases that were previously made under the repair and maintenance order P-22 or P-100.

Wholesalers Still Use PD-25C

Non-manufacturer jobbers and wholesalers have a vital integral role in the operation of Priorities Order P-90, outlined on this page. It is through their reports to their manufacturer-suppliers that the manufacturers obtain the necessary data to support an application for a rating, or ratings, under the Production Requirements Plan to obtain materials required to turn out the goods for jobbers' shelves.

These reports are made by jobbers on Form PD-25C, just as many wholesalers have been making them out for some time for manufacturers operating under the now obsolete Defense Supplies Rating Plan. The form is still the same; its function is still the same; its importance is still the same.

Jobbers also continue, under PURP, to use Form PD-25D to obtain from their customers definite identification of orders which do not bear specific priority ratings, as being in a defense category.

Raw Materials Allocation Orders

(Allocation status of raw materials of interest to utilities and suppliers. These orders involve distribution by OPM of raw materials at the basic processing stages; not allocation to industry or by end product use. There are variations in the procedure; most common are monthly OPM approval of producers' shipping schedules and establishment of a reserve pool.)

Commodity	Order Number	Method of Distribution	Administering OPM Unit	Users File—
Alcohol				
Ethyl, compounds	M-30*	No restrictions after filling defense orders.	Chemicals	
Methyl	M-31*	After filling defense orders, denaturant for ethyl gets B-4; anti-freeze and denaturant for solvents B-8; 30-day inventory limit.		
Aluminum, alloys	M-1	OPM approves monthly shipping schedules.	Aluminum & Magnesium	PD-40, 97, 114
	M-1a	Schedule for civilian (B) ratings.		
scrap, secondary	M-1c	Deliveries on rated orders only.		
Chlorinated hydrocarbons (refrig.)	M-28	Four specified classes of use get supplies after defense needs are met.	Chemicals	PD-160, 161, 162
Chlorinated hydrocarbons solvents	M-41	Reserve pool; formula for civilian deliveries	Chemicals	PD-127
Chlorine	M-19*	Users apply to producers by 5th of preceding month; OPM approves delivery schedules; reserve pool.	Chemicals	PD-63a, 190
Chromium, alloys, scrap	M-18a*	Users apply to OPM by 25th of preceding month; OPM specifies deliveries; Government sole importer	Manganese & Chromium	PD-53, 54, 55
Copper, alloys, products	M-9a*	Fabricator gets certificate from OPM on producer; Government sole importer.	Copper & Zinc	PD-59 (rev.), 175
Copper scrap, base alloy scrap	M-9c*	Limits and prohibits many civilian uses		PD-167, 172, 189
	M-9b	Deliveries on rated orders only.		PD-130
Cork, products	M-8	OPM directs distribution.	Cork & Asbestos	PD-28, 29 (rev.)
	M-8a	Restricts certain uses.		
Cutting Tools	E-2a	No restrictions after filling defense orders.	Tools	
Formaldehyde, synthetic resins	M-25*	Civilian deliveries limited to specified uses; utility uses in top bracket with B-4.	Chemicals	
Iron, steel scrap	M-24	OPM approves monthly shipping schedules.	Iron & Steel	PD-150
Lead	M-38, a, b	OPM approves monthly shipping schedules; reserve pool; Government sole importer	Tin & Lead	PD-66 (rev.)
Machine Tools	E-1*	Distribution regulated by OPM urgency list.	Tools	
Magnesium	M-2b	Deliveries only on orders rated A-1-j or higher.	Aluminum & Magnesium	PD-40M
Manila fiber, cordage	M-36*	Deliveries permitted only for specified uses and on A-1-j or higher ratings; class C cordage prohibited.	Textile, Clothing, Equipage	PD-128
Nickel	M-6a	Users must apply to producers and OPM by 20th of preceding month; OPM approves delivery schedules.	Nickel	PD-27 (schedule 1 & 2)
Phenols	M-27*	OPM specifies deliveries.	Chemicals	PD-180
Polyvinyl Chloride	M-10	OPM specifies deliveries.	Chemicals	PD-36 (rev.)
Pig Iron	M-17	OPM approves monthly shipments; reserve pool.	Iron & Steel	PD-32, 69, 70
Rubber	M-15,a*	OPM specifies deliveries; government sole importer	Rubber	
	M-15b*	Limits and prohibits many civilian uses		
	M-15c	Tire rationing program		
chlorinated	M-46	OPM specifies deliveries		PD-143, 144
synthetics	M-13	OPM specifies deliveries		PD-36(rev)
Steel	M-21*	OPM may direct deliveries and mill schedules; plates deliveries specified by OPM; supply after defense orders unrestricted.	Iron & Steel	PD-32, 73
alloys	M-21a*	Production restricted to orders of A-10 or better.		
merchant stocks	M-21b*	Establishes quotas of "merchant stocks" for warehouses.		PD-83
Tin	M-43	OPM specifies deliveries; Government sole importer.	Tin & Lead	
	M-43a	Limits and prohibits many civilian uses		
Tungsten high-speed steel	M-29, a	Apply for allocation; OPM specifies deliveries. Government sole importer.	Tungsten	PD-9
	M-14	Class B orders prohibited where Class A would do; Class A orders cannot exceed weight of Class B.		
Vanadium	M-23a	Users apply before 20th of preceding month; OPM specifies deliveries; Government sole importer.	Tungsten	PD-84
Zinc	M-11	Reserve pool; supply after filling defense orders prorated among users; Government sole importer.	Copper & Zinc	PD-20, 50, 62, 94

*Indicates amendments to original order.

Limited Blanket Rating Orders

(A summary of the more important priorities orders of interest to utilities and suppliers which are available to specified concerns to enable them to obtain scarce materials for certain defined production or to maintain essential operations)

Production or Operation	Order Number	Forms Used	Rating	Materials Which May Be Obtained	Administering OPM Unit
Autos, trucks, buses					
Replacement parts	P-57*		A-10	Necessary materials	Automotive
Buses, carriers	P-54*		A-3	Specifically listed items	
Bombers					
Sights, fire control	P-9-e	PD-47, A	A-1-b	Critical list items, perishable tools	Aircraft
Turbo superchargers	P-9-f	PD-48, A			
Conveyor machinery	P-78	PD-81, 82, A	A-3	Specifically listed items	Ind. & Office Machinery
Copper, alloy scrap	P-61	PD-126	A-10	Copper scrap; no brass mill scrap	Copper & Zinc
Cranes & hoists	P-5-b	PD-81, A	A-10 & up	Necessary materials	Tools
Defense projects	P19-a		Assigned	(See Page 43, this Supplement)	Various
Electrical relays, solenoid assemblies	P-15	PD-57, A	A-1-d	Critical list items, perishable tools	Aircraft
Elevators, escalators, repair parts	P-91	PD-81, 82	A-2	Critical list items	Ind. & Office Machinery
	P-72		A-3		
Foundry equipment, repair parts	P-31*	PD-81	A-1-b, c	Specifically listed items	Tools
Furnaces, heat treating	P-74*	PD-81	A-1-c	Specifically listed items	Tools
Housing, defense	P-55	PD-105	Assigned	Items on Housing Critical List	Field Service
Industrial lift trucks	P-40	PD-81	A-1-g	Necessary materials	Tools
Iron & steel, maintenance, repair	P-68*	PD-148	A-3	Maintenance, repair, operating supplies	Iron & Steel
			A-1-a, c		
Metal working equipment	P-11-a*	PD-81	A-1-a, b, c	Specifically listed items	Tools
Mines	P-56-a*	PD-119	A-8, A-3	Maintenance, repair, operating supplies; certain new machinery	Mine Priorities
		Endorsed orders	A-1-a, c		
Petroleum supplies	P-83	PD-82, A	A-8	Specified "shelf" supplies	Petroleum Coordinator
Production requirements	P-90	PD-25A	Assigned	(See Page 44, this supplement)	PRP Branch
Radios					
Commercial equipment	P-16	PD-58, A	A-1-c	Critical list items, perishable tools	Electric Appliances
Radiosondes	P-38	PD-6, A	A-1-d	Necessary materials	Ordnance
Repair, maintenance (general)	P-100	Endorsed orders	A-10	Repair, maintenance, operating supplies (See Page 41, this supplement)	Priorities
Research laboratories	P-43	PD-88, 93	A-2	Necessary materials	Chemicals
Tanks, light					
Equipment	P-25-a		A-1-f		
Engines (gas, diesel)	P-25-d				
Tanks, heavy		PD-81		Necessary materials	Combat vehicles
Equipment	P-26-a		A-1-d		
Engines (gas, diesel)	P-26-d				
Textile mills	P-53*	PD-81	A-10	Maintenance and repair parts	Textile machinery
Utilities	P-46*	Endorsed orders	A-10	(See Pages 40 and 41, this supplement)	Power

Limitation Orders

(A summary of the major priorities orders specifically curtailing production of civilian consumers goods)

Commodity	Order Number	Method of Curtailment	Administering OPM Unit
Amusement machines	L-21	Monthly unit quotas based on year ending 6/30/40	Consumers Durable Goods
Automobiles	L-2-a*	Monthly unit quotas based on year ending 6/30/40; all production to cease after January; retail sales prohibited pending rationing plan	Automotive
Cellophane	L-20	Prohibition of use for certain packaging	Conservation
Chlorine	L-11	Restricts use in pulp paper, paperboard	Chemicals
Cooking appliances (dom.)	L-23	Limits maximum use of iron and steel to fixed percentage of year ending 6/30/40; cover tops and bright work prohibited	Consumers Durable Goods
Electric Power	L-16*	Mandatory pooling of generation in seven southeastern states; blackout of non-essential lighting; industrial use quotas	Power
Laundry equipment (dom)	L-6*	Monthly unit quotas based on year ending 6/30/40	Consumers Durable Goods
Motor Carriers			
Medium trucks	L-1-a*	Monthly unit quotas based on year ending 6/30/40; retail sales prohibited pending rationing plan	Automotive
Light trucks	L-3*		
Refrigerators (dom)			
Ice	L-7	Limits maximum use of iron and steel to fixed percentage of year ending 6/30/40	Consumers Durable Goods
Mechanical	L-5*	Monthly unit quotas based on year ending 6/30/40	
Replacement parts autos and trucks	L-4	Monthly unit quotas based on year ending 6/30/40	Automotive
Vacuum Cleaners	L-18	Monthly unit quotas based on year ending 6/30/40	Consumers Durable Goods

*Indicates original order has been amended

Use Feeder Regulators, Save Critical Materials

Materials and man-hours saved — Required voltage conditions met — Systems loaded closer to thermal limits — Rebuilding or addition of circuits deferred or eliminated

O. B. FALLS, Distribution Systems Section, Central Station Eng. Dept., General Electric Co., Schenectady

ONE of the first results of the increases in demand for power will be excessive voltage drops on many existing distribution systems.

Reasonable voltage conditions are absolutely necessary if maximum production is to be maintained, for the reason that good voltage is necessary to the proper functioning of equipment such as motors and lights. Motors, although designed to operate reasonably satisfactorily at ±10 percent from their rated voltage, do not develop their best characteristics over this wide range. For example, if induction motors should operate on 90 percent voltage, the operating characteristics would be affected as follows:

Starting and maximum running torque	decrease 19 percent
Percent slip	increase 23 percent
Full load speed	decrease 1.5 percent
Full load efficiency	decrease 2 points
Full load current	increase 11 percent
Full load temperature rise	increase 6-7 C.
Maximum overload capacity	decrease 19 percent

Fluorescent lamps are being used more and more for factory lighting, in many ordnance and strictly war-production plants, including engineering and drafting divisions where vital war equipment is being designed and drafted.

For fluorescent lamps the operating range for best performance is approximately 12.7 percent of rated voltage. Lamps rated 118 volts may go out or fail to start at voltages below 110 volts and failure of auxiliaries may take place for voltages in excess of 125 volts. At 110 volts a fluorescent lamp rated 118 volts will have lost 8 percent of its rated lumen output. Incandescent lamps show a reduction of approximately 30 percent in lumen output with an applied voltage 10 percent below the rated voltage. Operation of incandescent lamps at voltages above the rated value results in a pronounced reduction in lamp life. A reasonable range in voltage over which either incandescent or fluorescent lamps will operate satisfactorily is ±3 percent, and such a range in voltage is necessary if the required quality and quantity of production is to be maintained.

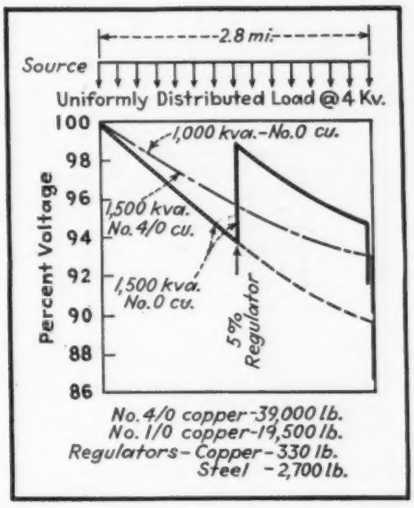

FIG. 1—Regulator on 4-kv. feeder saves 9 tons of copper at expense of 100 man-hours and 2,700 lb. of steel

A reasonable range of voltage regulation is therefore necessary for the successful operation of motors and motor-operated equipment, and a somewhat closer range for lighting circuits is quite essential to the speed-up in production under the existing wartime conditions.

How can it be shown that the use of voltage regulators permits conservation of critical materials? It must be remembered that the OPM must necessarily limit or eliminate priorities based on economic advantages or on equipment desired merely to improve conditions where existing conditions are reasonably tolerable. We propose to explore, therefore, only those conditions where voltage conditions would, without correction, reach such an intolerable state that connected apparatus would not function properly. In none of these cases will the economics be considered, although they will be present, and favorably so, as in the past.

One fundamental point is that, considering those wire sizes commonly used by utilities, the use of the next larger size of wire results in using approximately 25 percent more material. To illustrate this point the following examples have been worked out to indicate the possibilities for considerable savings in copper consumption. In all of these examples the limiting voltage conditions assumed are those applying to motors, appliances, etc., rather than those applying to lighting circuits. If those applying to lighting circuits were used considerably greater conservation of materials would be evident. In this connection it should be remembered that on most industrial and commercial feeders voltage requirements for power loads can be taken care of as shown in the following analyses, with cases of lighting voltage difficulties taken care of by individual voltage regulators.

A 4-Kv., No. 0 Feeder

For the first case assume a feeder as shown in Fig. 1. This feeder is 2.8 miles long, is uniformly loaded

and consists of No. 0 copper. The drop along the feeder with 1,000 kva. of load will be 7 percent. If we assume a 3 percent drop in the last transformer and service the resultant 10 percent drop might be considered as tolerable. If this load should increase to 1,500 kva. the drop would increase to 13.5 percent, and motors, appliances, etc., would not function properly. Therefore, some corrective means would be required. Thermally the No. 0 copper would carry this increased load. However, if No. 4/0 copper were used the total load could be carried with a voltage drop of 10.3 percent at the last customer, which is practically the same as before the 500 kva. load was added.

Replacing the existing No. 0 conductor with No. 4/0 conductor would require 39,000 lb. of new copper. If the No. 0 conductor was retained and three 5 percent single-phase regulators used the added load could be carried without exceeding the original voltage drop. The necessary regulators would require approximately 350 lb. of copper and 2,700 lb. of steel. The No. 0 conductor in this circuit would weigh 19,500 lb. and if it were credited to the job the net amount of copper saved would amount to approximately 19,150 lb. Partially offsetting this there would be required the 2,700 lb. of steel. However, the majority of the steel required would be core steel, which seems to be more readily available and does not require the same manufacturing facilities as does steel plate, which is so sorely needed for armament. In addition, the rebuilding of this line with heavier conductors would require a substantial increase in the amount of galvanized steel fittings, braces, guy wires, etc., due to additional construction items and to the replacement of certain items with heavier stock. This steel plus the critical materials required for galvanizing should be balanced against the steel in the regulators.

That is the story of the raw copper and steel involved. But these are not the only "raw materials" which it is desirable to conserve. Man-hours are also important. We find that approximately 50 man-hours would be necessary to make the necessary No. 4/0 conductor from copper bar and approximately 200 to take down the No. 0 and install the No. 4/0—a total of 250 man-hours. It is estimated that the manufacture of three single-phase induction regulators would involve a total of 350 man-hours. This figure includes fabrication of parts involved in making the regulators, but does not include factory overhead, maintenance, etc.

This leaves a balance of about 100 man-hours in favor of replacing the conductors, so that the final result is 100 man-hours and something considerably less than 2,700 lb. of steel against the regulators and 19,150 lb. of copper in favor of the regulators.

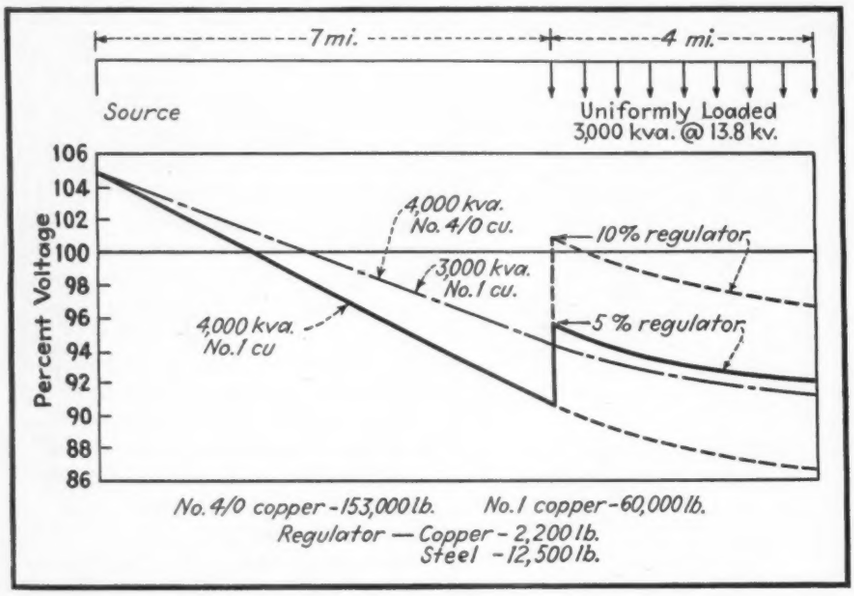

FIG. 2—On a 13.8-kv. feeder both man-hours (350) and copper (45 tons) are saved by regulators involving 6 tons of steel

For the second case refer to Fig. 2. This feeder, representative of the type found serving large commercial and industrial areas, has the following characteristics:

Circuit voltage		13.8 kv., 4-wire
Distributed load	3,000	kva., 0.75 p.-f.
Length—express		7 miles
load area		4 miles
Conductor		No. 1
Load to be added	1,000	kva., 0.75 p.-f.

This feeder is assumed to come from a substation where there is a maximum of 5 percent regulation available at times of full load on the feeder. Total voltage drop on the feeder due to existing load is 14 percent, resulting in a voltage drop at the end of the feeder of 9 percent. Such voltages as are shown in Fig. 2 would be considered tolerable on most commercial or industrial feeders. However, if the load must be increased to 4,000 kva. the voltage drop at the end of the feeder would be 13.5 percent, including the 5 percent regulation at the substation.

Replacements

The No. 1 conductor would be satisfactory to carry the total load thermally, but if it were replaced with No. 4/0 conductor approximately the same voltage conditions would be obtained as prior to the addition of the 1,000-kva. load. The required No. 4/0 conductor would weigh 153,000 lb., whereas the No. 1 conductor already up would weigh 60,000 lb. If, instead of replacing the conductors, a 5 percent regulator were installed approximately the same voltage conditions would obtain as with No. 4/0 conductor. This three-phase step-voltage regulator would require approximately 2,200 lb. of copper and 12,500 lb. of steel. Crediting the weight of the No. 1 copper, this scheme would show a saving of about 91,000 lb. of copper. Again, as in the first example, the replacement of the No. 1 conductor with No. 4/0 would require an indeterminate amount of galvanized steel material which should be balanced against the steel in the regulator.

As for the man-hours involved, it would require approximately 1,000 to take down the old and install the new conductors and 300 man-hours to make the required No. 4/0 conductor from copper bar—a total of 1,300 man-hours. The regulators would require about 950 man-hours to manufacture, including the time to make the wire for windings from

copper bar, punch out core laminations and cut and form the steel parts involved. In this case there is a balance of 350 man-hours in favor of using regulators plus the 91,000 lb. of copper saved.

As an alternative to the above, another express circuit could be built for 7 miles to help pick up the additional load. If this were No. 1 conductor 38,000 lb. of copper would be required and approximately 5,000 man-hours of labor, including about 1,000 for line crews and skilled labor and 600 for transportation of materials. Also the following list of materials:

Steel guy wire	800 lb.
Copper and steel for ground rods and leads	1,500 lb.
Galvanized steel braces, bolts, washers, anchor rods, plates, etc.	2,000 lb.
Poles	150
Crossarms	180
Pins and insulators	720

Some of these items are not yet on the list of critical materials, but they all require man-hours and factory space to fabricate, in addition to transportation.

Load Center Problem

As a third example, consider the problem presented in determining the best system to serve an area 2 miles square, having a total load of 1,400 kva. fed from a substation located 2 miles from the load center of the designated area.

The upper left-hand diagram of Fig. 3 illustrates a conventional load center type feeder which is commonly employed today to serve such an area. In this case a No. 4/0 feeder is run from the substation to the load center with three-phase laterals of No. 2 copper radiating in four directions from the load center, with the necessary single-phase branches from these laterals to serve the area. Immediately below the diagram are shown the voltage conditions prevailing with the feeder loaded to 200 amp. on the basis of the voltage on the feeder at the substation being 110 percent. It will be noted that the highest primary voltage in the load area is 98.3 percent and the lowest 94.9 percent. Actually in such a case it would be necessary to maintain a voltage above 110 percent at the substation, in order to give better average voltage in the load area.

The upper right-hand diagram of Fig. 3 illustrates a second method by which such an area might be served. This feeder is of the so-called tree type, which is less advantageous from the standpoint of voltage deviation within the load area than is the load center type. However, it is not only possible to overcome this limitation of the tree type feeder by the installation of regulators as shown in the sketch, but it is also possible to save a quantity of materials. With No. 0 copper used for the main feeder voltage conditions will prevail as indicated in the diagram immediately below this sketch. It will be noted that the maximum voltage in the load area is 100.5 percent and the minimum 96.6 percent, giving a voltage deviation in the area practically as good as with the load center arrangement.

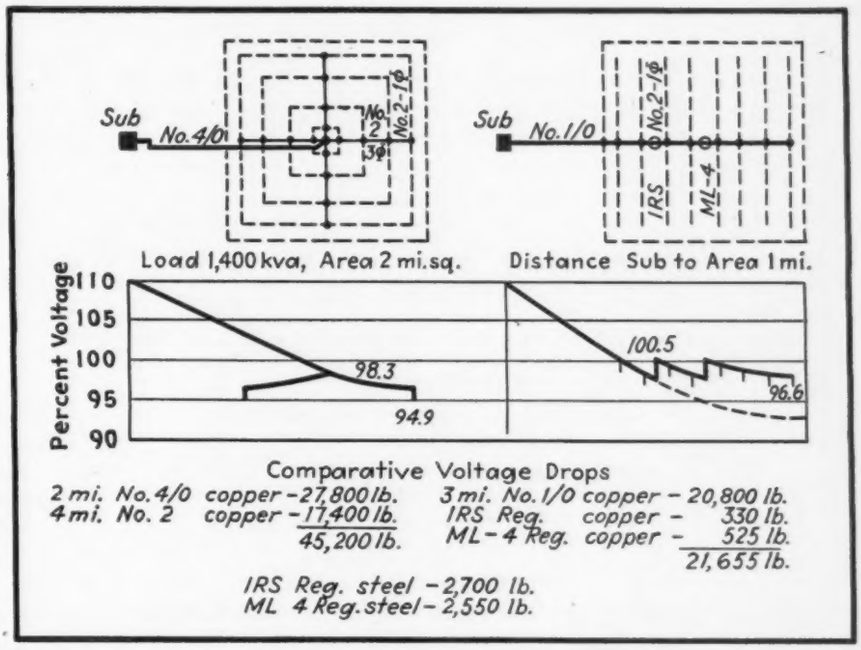

FIG. 3—Load-center regulation equally advantageous in conserving critical materials

From the standpoint of materials, it is found that the single-phase branch circuits under the two alternatives are equal and may, therefore, be neglected in our comparison. With the load center type arrangement the two miles of No. 4/0 conductor and four miles of No. 2 conductor will weigh 45,200 lb. In the tree type arrangement the 3 miles of No. 0 conductor will weigh only 20,800 lb. and the two sets of regulators will involve copper weighing about 855 lb. and steel about 5,250 lb. This leaves a balance of copper saved in favor of the tree type arrangement of about 23,550 lb. Against this balance of copper, 5,250 lb. of steel is required. Man-hours involved in building either scheme are approximately the same.

Definitely a Tool

These examples indicate the extent to which it is possible to conserve raw materials and man-hours under certain conditions. Some of these solutions to immediate problems of voltage regulation may also turn out to be the most economical from the standpoint of permanent installations. On the other hand, it is entirely possible that these solutions will be neither most desirable nor most economical from that standpoint. Furthermore, such solutions might allow only very little additional load growth in the given area without other changes being required. In case No. 2 the 5 percent regulator might be inadequate for the future and the final decision might be to use a 10 percent regulator if the feeder could stand additional load thermally and if the necessary priority could be obtained (see Fig. 2).

From the standpoint of an all-out war effort the feeder voltage regulator is definitely a tool to be used in the conservation of materials. The use of regulators involving relatively small quantities of copper and steel means that the utilities should be able to get priorities on regulators more easily than on copper for building or rebuilding lines.

Classified Sources of Defense Blackout Devices

Producers making equipment and materials related to those found appropriate for control of light sources during air raids listed here — Many already undertaking design of equipment for semi-blackouts

BLACKOUTS are in the offing. Some tests were made and reported earlier this year, but now our sudden thrust into war during the week of December 7 has stirred nationwide interest and caused an acceleration of plans and tests. They have already disclosed that we are generally unready with physical facilities even though the principles had been well set forth in the publication "Blackouts" of the Office of Civilian Defense, dated August, 1941. That authoritative analysis of what the United States can and should do to capitalize on European experience, good and bad, is the basis for the planning that now has been intensified.

But where can one turn for the devices that are going to be needed to effectuate such programs as are instituted?

Actually there are a very few concerns that have engaged exclusively in the field of fabricating equipment specifically for use in conjunction with blackouts. Most of them are more in the direction of fire and other protection and salvage operations during actual air raids rather than in the field of blackouts in advance of raids.

Consequently the provision of equipments and facilities geared to the needs of the protective blackout appears to rest largely upon producers of comparable peacetime devices for seeing, for alarms, for emergency power supply, for signs and for ventilation. The best that can be done at the moment is to list recognized concerns which make peacetime products akin to what is seen to be wanted for the new emergency. The following list is thus not all-inclusive nor is it intended to be a list of places where one can place orders, but rather of places where one could excusably direct inquiries or make proposals.

This list is presented in ELECTRICAL WORLD as the editors' immediate contribution toward a situation that may at any moment become pressing.

MASKS, SHADES AND VISORS
for normal lights

Street-Lighting Fixtures and Fittings

American Street Illuminating Co., 1500 Walnut St., Philadelphia, Pa.
Benjamin Electric Mfg. Co., Des Plaines, Ill.
Brady Electric & Mfg. Co., 42 Center St., New Britain, Conn.
Delta-Star Electric Co., 2400 Block, Fulton St., Chicago, Ill.
Dunlap Co., John, Carnegie, Pa.
Electric Railway Equipment Co., Cormany Ave. at Township St., Cincinnati, Ohio
Fletcher Mfg. Co., Second & Canal Sts., Dayton, Ohio
General Electric Co., Schenectady, N. Y.
Hartford Faience Co., 271 Hamilton St., Hartford, Conn.
Herwig Co., 1758 Sedgwick St., Chicago, Ill.
Hubbard & Co., 6301 Butler St., Pittsburgh, Pa.
Klemm Reflector Co., 134 N. Fifth St., Philadelphia, Pa.
Line Material Co., 740 N. Second St., Milwaukee, Wis.
Multi Electrical Mfg. Co., 1840 W. 14th St., Chicago, Ill.
Oliver & Steep Corp., 1001 Muriel St., Pittsburgh, Pa.
Overbagh & Ayres Mfg. Co., 411 S. Clinton St., Chicago, Ill.
Philadelphia Electrical & Mfg. Co., 1206-36 N. 31st St., Philadelphia, Pa.
Union Metal Mfg. Co., 1432 Maple Ave., N.E., Canton, Ohio
Utilities Service Co., Foot of Allen St., Allentown, Pa.
Westinghouse Electric & Mfg. Co., Lighting Div., Edgewater Pk., Cleveland, Ohio
Wheeler Reflector Co., 275 Congress St., Boston, Mass.

Bulls-Eye Lights

Alden Products Co., 715 Center St., Brockton, Mass.
Arrow-Hart & Hegeman Electric Co., 103 Hawthorne St., Hartford, Conn.
Bryant Electric Co., 1421 State St., Bridgeport, Conn.
Circle F Mfg. Co., 720 Monmouth St., Trenton, N. J.
Dial Light Co. of America, Inc., 90-92 West St., New York, N. Y.
Drake Mfg. Co., 1713 W. Hubbard St., Chicago, Ill.
General Electric Co., Appliances and Merchandise Dept., Bridgeport, Conn.
Hart Mfg. Co., 110 Bartholomew Ave., Hartford, Conn.
Hubbell Inc., Harvey, State St. & Bostwick Ave., Bridgeport, Conn.
Kirkland Co., H. R., Morristown, N. J.
Pass & Seymour, Inc., Solvay Station, Syracuse, N. Y.
R-B-M Mfg. Co., Logansport, Ind.
Signal Indicator Co., 140 Cedar St., New York, N. Y.

Lamp Hoods

Benjamin Electric Mfg. Co., Des Plaines, Ill.
Betts & Betts Corp., 551 W. 52d St., New York, N. Y.
Kliegl Bros., Universal Electric Stage Lighting Co., 321 W. 50th St., New York, N. Y.
Macbeth-Evans Glass Div., Corning Glass Works, Charleroi, Pa.
Outdoor Lighting Corp., Booraem & Central Aves., Jersey City, N. J.
Reynolds Electric Co., 2650 W. Congress St., Chicago, Ill.

Reflectors and Shades

A-A Electric Mfg. Co., 305 Center St., Bridgeport, Conn.
American Reflector & Lighting Co., 626 W. Jackson Blvd., Chicago, Ill.
Benjamin Electric Mfg. Co., Des Plaines, Ill.
Bright Light Reflector Co., Brooklyn, N. Y.
Bryant Park Electric Co., 260 W. 41st St., New York, N. Y.
Chesler & Sons Co., J., 141 Harrison Pl., Brooklyn, N. Y.
Consolidated Lamp & Glass Co., Coraopolis, Pa.
Corning Glass Works, Corning, N. Y.
Curtis Lighting, Inc., 6135 W. 65th St., Chicago, Ill.
Day-Brite Lighting, Inc., 5405 Bulwer Ave., St. Louis, Mo.
Dynax Reflector Co., 2609 Washington Ave., St. Louis, Mo.
Electric Equipment Co., 2400 W. Madison St., Chicago, Ill.
Ender Mfg. Co., 260 West St., New York, N. Y.
Erskine Glass & Mfg. Co., Wellsburg, W. Va.
Faries Mfg. Co., 1036 E. Grand Ave., Decatur, Ill.
Fostoria Pressed Steel Corp., Fostoria, Ohio
Frink Corp., 23-10 Bridge Plaza, S., Long Island City, N. Y.
Garden City Plating & Mfg. Co., 1430 S. Talman Ave., Chicago, Ill.
General Electric Co., Schenectady, N. Y.
Gill Glass & Fixture Co., Amber & Tioga Sts., Philadelphia, Pa.
Gillinder Bros., Port Jervis, N. Y.
Gleason-Tiebout Glass Co., 59-50 54th St., Maspeth, N. Y.
Goodrich Electric Co., Belle Plaine & Kilpatrick St., Chicago, Ill.
Guth Co., Edwin F., 2615 Washington, St. Louis, Mo.
Klemm Reflector Co., 134 N. Fifth St., Philadelphia, Pa.
Holophane Co., 342 Madison Ave., New York, N. Y.
Hubbell, Inc., Harvey, State St. & Bostwick Ave., Bridgeport, Conn.
Inland Glass Works, 841 N. Wabash Ave., Chicago, Ill.
Irmischer Co., A. P., 1532 Clybourn Ave., Chicago, Ill.
Jackson Electrical Co., 900 W. Van Buren St., Chicago, Ill.
Jones Metal Products Co., West Lafayette, Ohio
Kees Mfg. Co., F. D., Box 140, Beatrice, Neb.
Kelley, Inc., Frank, 8115 Forrest Ave., Elkins Park, Pa.
Kent Metal Mfg. Co., 490 Johnson Ave., Brooklyn, N. Y.
Kliegl Bros. Universal Electric Stage Lighting Co., 321 W. 50th St., New York, N. Y.
Kopp Glass, Inc., Palmer & Carrie Sts., Swissvale, Pa.
Light & Power Patented Utilities Co., 122 Fifth Ave., New York, N. Y.
Lightolier, 11 E. 36th St., New York, N. Y.
Line Material Co., 740 N. Second St., Milwaukee, Wis.
Macbeth-Evans Glass Div., Corning Glass Works, Charleroi, Pa.
McKee Glass Co., Jeanette, Pa.
Miller Co., 101 Center St., Meriden, Conn.
Multi Electrical Mfg. Co., 1840 W. 14th St., Chicago, Ill.

Overbagh & Ayres Mfg. Co., 411 S. Clinton St., Chicago, Ill.
Phoenix Glass Co., 405 Lexington Ave., New York, N. Y.
Pittsburgh Reflector Co., Oliver Bldg., Pittsburgh, Pa.
Quadrangle Mfg. Co., 32 S. Peoria St., Chicago, Ill.
Reflectors, Inc., 3225 Frankford Ave., Philadelphia, Pa.
Revere Electric Mfg. Co., 2941 N. Paulina St., Chicago, Ill.
Reynolds Electric Co., 2650 W. Congress St., Chicago, Ill.
Rodale Mfg. Co., Sixth & Minor Sts., Emaus, Pa.
Silvray Corp., 47-02 31st Pl., Long Island City, N. Y.
S & M Lamp Co., 119 W. 36th Pl., Los Angeles, Cal.
Smoot-Holman Co., Inglewood, Cal.
Spere Electric Corp., 18222 Lanken Ave., Cleveland, Ohio
Steber Mfg. Co., 1020 W. Adams St., Chicago, Ill.
Sterling Reflector Co., 1435 W. Hubbard St., Chicago, Ill.
Sunlight Reflector Co., 226 Pacific St., Brooklyn, N. Y.
Westinghouse Electric & Mfg. Co., Lighting Div., Edgewater Pk., Cleveland, Ohio
Wheeler Reflector Co., 275 Congress St., Boston, Mass.
Wilson Lighting, Inc., 156 W. Erie St., Chicago, Ill.
Wiremold Co., Hartford, Conn.
Wuelker Lighting Co., 161 Seventh St., San Francisco, Cal.

SWITCHES AND CONTROLS

Time, Automatic, Normal and Remote

Photo-Electric Cells

Bradley Laboratories, 82 Meadow St., New Haven, Conn.
Burt Scientific Laboratories, R.C., 1212 E. Green St., Pasadena, Cal.
Continental Electric Co., Geneva, Ill.
De Vry, Herman A., 1111 W. Center St., Chicago, Ill.
General Electric Co., Schenectady, N. Y.
General Scientific Corp., 4829 S. Kedzie Ave., Chicago, Ill.
G-M Laboratories, Inc., 4314 N. Knox Ave., Chicago, Ill.
RCA Mfg. Co., Camden, N. J.
Westinghouse Electric & Mfg. Co., Westinghouse Lamp Div., Bloomfield, N. J.
Weston Electrical Instrument Corp., 639 Frelinghuysen Ave., Newark, N. J.

Current Control Relays

Acme Fire Alarm Co., 36 W. 15th St., New York, N. Y.
Adams & Westlake Co., Elkhart, Ind.
Advance Electric Co., 1260 W. Second St., Los Angeles, Cal.
Allen-Bradley Co., 1305 S. First St., Milwaukee, Wis.
Allied Control Co., 227 Fulton St., New York, N. Y.
American Automatic Electric Sales Co., 1036 W. Van Buren St., Chicago, Ill.
American Gas Accumulator Co., Electrical Div., Elizabeth, N. J.
American Instrument Co., 8010 Georgia Ave., Silver Spring, Md.
Automatic Switch Co., 41 E. 11th St., New York, N. Y.
Automatic Temperature Control Co., 34 E. Logan St., Philadelphia, Pa.
Bristol Co., Waterbury, Conn.
Clare & Co., C. P., 4719 W. Sunnyside Ave., Chicago, Ill.
Clark Controller Co., 1146 E. 152d St., Cleveland, Ohio
Colt's Patent Fire Arms Mfg. Co., Electrical Div., Hartford, Conn.
Condit Works, Allis-Chalmers Mfg. Co., Hyde Park Station, Boston, Mass.
Cramer Co., R. W., Centerbrook, Conn.
Cutler-Hammer Inc., 1401 W. St. Paul Ave., Milwaukee, Wis.
Dunn, Inc., Struthers, 1401 Cherry St., Philadelphia, Pa.
Durakool, Inc., 1010 N. Main St., Elkhart, Ind.
Eagle Signal Corp., Moline, Ill.
Electric Controller & Mfg. Co., 2701 E. 79th St., Cleveland, Ohio
Gardiner-Levering Co., Haddon Heights, N. J.
General Controls Co., 801 Allen Ave., Glendale, Calif.
General Electric Co., Schenectady, N. Y.
Guardian Electric Mfg. Co., 1621 W. Walnut St., Chicago, Ill.
Hart Mfg. Co., 110 Bartholomew Ave., Hartford, Conn.
Hartman Electrical Mfg. Co., Mansfield, Ohio
H-B Electric Co., 2520 N. Broad St., Philadelphia, Pa.
I-T-E Circuit Breaker Co., 1890 Hamilton St., Philadelphia, Pa.
Jefferson Electric Co., Bellwood (Suburb of Chicago), Ill.
Kurman Electric Co., 241 Lafayette St., New York, N. Y.
Leach Relay Co., 5915 Avalon Blvd., Los Angeles, Cal.
Norton Electrical Instrument Co., Manchester, Conn.
Palmer Electric & Mfg. Co., Wakefield, Mass.
Potter & Brumfield Mfg. Co., Princeton, Ind.
Powrex Switch Co., 36 Pleasant St., Watertown, Mass.
R-B-M Mfg. Co., Logansport, Ind.
Roller-Smith Co., Bethlehem, Pa.
Safety Car Heating & Lighting Co., 230 Park Ave., New York, N. Y.
Signal Engineering & Mfg. Co., 152 W. 14th St., New York, N. Y.
South Bend Current Controller Co., P. O. Drawer 2038 River Pk., South Bend, Ind.
Square D Co., 6060 Rivard St., Detroit, Mich.
Standard Electrical Products Co., 417 First Ave., N., Minneapolis, Minn.
Thompson, Inc., O., 44-35 Purvis St., Long Island City, N. Y.
Trumbull Electric Mfg. Co., Plainville, Conn.
United Electric Controls Corp., 40 Exchange Pl., New York, N. Y.
Ward Leonard Electric Co., Mount Vernon, N. Y.
Western Electro-Mechanical Co., 300 Broadway, Oakland, Cal.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
Weston Electrical Instrument Corp., 639 Frelinghuysen Ave., Newark, N. J.

Photo-Electric Relays

Allen-Bradley Co., 1305 S. First St., Milwaukee, Wis.
Allied Control Co., 227 Fulton St., New York, N. Y.
Cutler-Hammer, Inc., 1401 W. St. Paul Ave., Milwaukee, Wis.
Dunn, Inc., Struthers, 1329 Cherry St., Philadelphia, Pa.
Gardiner-Levering Co., Haddon Heights, N. J.
General Electric Co., Schenectady, N. Y.
G-M Laboratories, Inc., 4314 N. Knox Ave., Chicago, Ill.
Lumenite Electric Co., Old Colony Bldg., Chicago, Ill.
Photobell Corp., 116 Nassau St., New York, N. Y.
Photoswitch Inc., 21 Chestnut St., Cambridge, Mass.
Rehtron Corp., 2159 Magnolia Ave., Chicago, Ill.
Rhamstine, J., Thomas, 301 Beaubien St., Detroit, Mich.
Sigma Instruments, Inc., 78 Freeport St. (Dorchester), Boston, Mass.
United Cinephone Corp., Torrington, Conn.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
Weston Electrical Instrument Corp., 639 Frelinghuysen Ave., Newark, N. J.

Signal Relays

Acme Fire Alarm Co., 36 W. 15th St., New York, N. Y.
Allied Control Co., 227 Fulton St., New York, N. Y.
American Automatic Electric Sales Co., 1033 W. Van Buren St., Chicago, Ill.
Auth Electrical Specialty Co., 422-430 E. 53d St., New York, N. Y.
Benjamin Electric Mfg. Co., Des Plaines, Ill.
Bunnell & Co., J. H., 215 Fulton St., New York, N. Y.
Cutler-Hammer, Inc., 1401 W. St. Paul Ave., Milwaukee, Wis.
Dunn, Inc., Struthers, 1329 Cherry St., Philadelphia, Pa.
Edwards & Co., Norwalk, Conn.
Gamewell Co., Newton, Mass.
General Electric Co., Schenectady, N. Y.
G-M Laboratories, Inc., 4314 N. Knox Ave., Chicago, Ill.
Guardian Electric Mfg. Co., 1621 W. Walnut St., Chicago, Ill.
Hart Mfg. Co., 110 Bartholomew Ave., Hartford, Conn.
Kurman Electric Co., 241 Lafayette St., New York, N. Y.
Lake Mfg. Co., 2323 Chestnut St., Oakland, Cal.
Leach Relay Co., 5915 Avalon Blvd., Los Angeles, Cal.
Line Material Co., 740 N. Second St., Milwaukee, Wis.
Ostrander Electric Works, W. R., 78 Prince St., Brooklyn, N. Y.
Partrick & Wilkins Co., 51 N. Seventh St., Philadelphia, Pa.
Potter & Brumfield Mfg. Co., Princeton, Ind.
R-B-M Mfg. Co., Logansport, Ind.
Roller-Smith Co., Bethlehem, Pa.
Signal Engineering & Mfg. Co., 152 W. 14th St., New York, N. Y.
Simpson Electric Co., 5218 W. Kinzie St., Chicago, Ill.
Square D Co., 6060 Rivard St., Detroit, Mich.
Standard Electric Time Co., 89 Logan St., Springfield, Mass.
Stanley & Patterson Div., Schwarze Electric Co., Adrian, Mich.
Ward Leonard Electric Co., Mount Vernon, N. Y.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

Clock-Controlled Switches

Anderson Mfg. Co., Albert & J. M., 305 A. St., Boston, Mass.
Automatic Electric Mfg. Co., 729 S. Front St., Mankato, Minn.
Bacon Electric Timer Corp., 4513 Brooklyn Ave., Cleveland, Ohio
Cleveland Time Clock & Service Co., Superior Ave. at E. 27th St., Cleveland, Ohio
Cramer Co., R. W., Centerbrook, Conn.
Electric Controls Corp., 68 Murray St., New York, N. Y.
General Electric Co., Schenectady, N. Y.
International Register Co., 2620 Washington Blvd., Chicago, Ill.
Leich Electric Co., Genoa, Ill.
Mercoid Corp., 4201 Belmont Ave., Chicago, Ill.
Northwestern Clock Co., Brown Bldg., Omaha, Neb.
Paragon Electric Co., 43 W. Van Buren St., Chicago, Ill.
Reliance Automatic Lighting Co., 1931 Mead St., Racine, Wis. "Badger"
Sangamo Electric Co., Springfield, Ill.
South Bend Current Controller Co., P. O. Drawer 2038 River Park, South Bend, Ind.
States Co., 3 New Park Ave., Hartford, Conn.
Swartzbaugh Mfg. Co., 1336 W. Bancroft St., Toledo, Ohio
Thompson Clock Co., H. C., 38 Federal St., Bristol, Conn.
Tork Clock Co., Mount Vernon, N. Y.
Wadsworth Electric Mfg. Co., 20 W. 11th St., Covington, Ky.
Walser Automatic Timer Co., 420 Lexington Ave., New York, N. Y.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
Zenith Electric Co., 835 S. Wabash St., Chicago, Ill.

DIMMERS

Manual and Motor-Operated Dimmers

Acme Electric Heating Co., 1217 Washington St., Boston, Mass.
Cutler-Hammer, Inc., 1401 W. St. Paul Ave., Milwaukee, Wis.
Kliegl Bros. Universal Electric Stage Lighting Co., 321 W. 50th St., New York, N. Y.
Ward Leonard Electric Co., Mount Vernon, N. Y.

FILTER AND HOODS

To modify normal light sources and to restrict direction of light

Color Hoods

Benjamin Electric Mfg. Co., Des Plaines, Ill.
Betts & Betts Corp., 551 W. 52d St., New York, N. Y.
Kliegl Bros., Universal Electric Stage Lighting Co., 321 W. 50th St., New York, N. Y.
Macbeth-Evans Glass Div., Corning Glass Works, Charleroi, Pa.
Outdoor Lighting Corp., Booraem & Central Aves., Jersey City, N. J.
Reynolds Electric Co., 2650 W. Congress St., Chicago, Ill.

Glass Lenses

Corning Glass Works, Corning, N. Y.
Deknatel & Son, J. A., 222d St. & 96th Ave., Queens Village, N. Y.
Electric Equipment Co., 2400 W. Madison St., Chicago, Ill.
Lancaster Lens Co., Lancaster, Ohio
Macbeth-Evans Glass Div., Corning Glass Works, Charleroi, Pa.
Schmiedecke, Chas. L., 66-55 69th St., Maspeth, N. Y.
Sneath Glass Co., Wabash Ave., Hartford City, Ind.
United Lens Co., Southbridge, Mass.

FLASHLIGHTS AND LANTERNS

for blackout emergency activities

Dry Batteries

Acme Battery Corp., 59 Pearl St., Brooklyn, N. Y.
Bright Star Battery Co., 200 Crooks Ave., Clifton, N. J.
Burgess Battery Co., Freeport, Ill.
Deal Electric Co., 453 Broome St., New York, N. Y.
Edison Storage Battery Div., Thomas A. Edison Inc., West Orange, N. J.
General Dry Batteries, Inc., 13109 Athens Ave., Cleveland, Ohio
Le Carbone Co., Myrtle Ave., Boonton, N. J.
National Carbon Co., 30 E. 42d St., New York, N. Y.
Ray-O-Vac Co., Madison, Wis.
Southern Battery Co., Appomattox, Va.
Triumph Co., Elkton, Md.
United States Electric Mfg. Corp., 222 W. 14th St., New York, N. Y.
Winchester Repeating Arms Co., New Haven, Conn.

Storage Batteries

American Battery Co., 162 W. Hubbard St., Chicago, Ill.
Am-plus Storage Battery Co., 425 W. Superior St., Chicago, Ill.
Bowers Battery Mfg. Co., Reading, Pa.
Edison Storage Battery Div., Thomas A. Edison, Inc., West Orange, N. J.
Electric Storage Battery Co., Allegheny Ave. & 19th St., Philadelphia, Pa.
General Lead Batteries Co., Chapel St. & Lister Ave., Newark, N. J.
General Storage Battery Co., 2005 Locust St., St. Louis, Mo.

Globe-Union, Inc., 900 E. Keefe Ave., Milwaukee, Wis.
Gould Div., National Battery Co., 35 Neoga St., Depew, N. Y.
K. W. Battery Co., 3705 N. Lincoln Ave., Chicago, Ill.
Philco (Battery Division), Philadelphia, Pa.
Prest-O-Lite Battery Co., 4500 W. 16th St., Indianapolis, Ind.
Solar Corp., 944 W. Bruce St., Milwaukee, Wis.
Universal Battery Co., 3410 S. La Salle St., Chicago, Ill.
USL Battery Corp., 1725 Highland Ave., Niagara Falls, N. Y.
Willard Storage Battery Co., 246 E. 131st St., Cleveland, Ohio

Batteryless Flashlights

Genaflash Co., 332 New Scotland Ave., Albany, N. Y.
Guedon, Camden, N. J.
Monarch Mfg. Co., 3341 Belmont Ave., Chicago, Ill.
Parker Mfg. Co., 2026 N. Clark St., Chicago, Ill.
Viz Corp., 335 E. Price St., Philadelphia, Pa.

Dry Battery Flashlights

Allbright Electric Corp., 119 W. 24th St., New York, N. Y.
Blake Mfg. Corp., Clinton, Mass.
Bridgeport Metal Goods Mfg. Co., Cherry & Pine Sts., Bridgeport, Conn.
Bright Star Battery Co., 200 Crooks Ave., Clifton, N. J.
Burgess Battery Co., Freeport, Ill.
Emeloid Co., Arlington, N. J.
Gem Electric Mfg. Co., 453 Broome St., New York, N. Y.
Kalb Electric Co., 2711 Big Bend Blvd., St. Louis, Mo.
Micro-Lite Co., 44 W. 18th St., New York, N. Y.
National Carbon Co., 30 E. 42d St., New York, N. Y.
Ray-O-Vac Co., Madison, Wis.
United States Electric Mfg. Corp., 222 W. 14th St., New York, N. Y.
Winchester Repeating Arms Co., New Haven, Conn.

Storage Battery Flashlights

Chargit Corp., Anderson, Ind.
Ideal Commutator Dresser Co., 1055 Park Ave., Sycamore, Ill. (Sole Distributors for Quirk Battery Co., Highland Park, Ill.)
Quirk Battery Co.—see Ideal Commutator Dresser Co.

Portable Dry Battery Lanterns

Allbright Electric Corp., 119 W. 24th St., New York, N. Y.
Burgess Battery Co., Freeport, Ill.
Carpenter Mfg. Co., 309 Sidney St., Cambridge, Mass.
Conger Lantern Co., 70 E. Sixth St., Portland, Ore.
Delta Electric Co., 3302 S. Nebraska St., Marion, Ind.
Grether Fire Equipment Co., 312 E. Second St., Dayton, Ohio
Handian-Buck Mfg. Co., 210 N. Third St., St. Louis, Mo.
Hutchison Engineering Works, 549 Washington Blvd., Chicago, Ill.
Justrite Mfg. Co., 2061 Southport Ave., Chicago, Ill.
National Carbon Co., 30 E. 42d St., New York, N. Y.
Portable Light Co., 25 Warren St., New York, N. Y.
Seiss Mfg. Co., 3835 Seiss Ave., Toledo, Ohio
Stern, Leo S. 369 Lexington Ave., New York, N. Y.
U-C Lite Mfg. Co., 509 N. Dearborn St., Chicago, Ill.
Winchester Repeating Arms Co., New Haven, Conn.

Portable Storage Battery Lanterns

Carpenter Mfg. Co., 300 Sidney St., Cambridge, Mass.
Koehler Mfg. Co., 395 Lincoln St., Marlboro, Mass.
Portable Light Co., 25 Warren St., New York, N. Y.

ULTRA-VIOLET LIGHTS

Ultra-Violet Light Sources

Black-Ray Lighting Co., 10415 St. Clair Ave., Cleveland, Ohio
Continental Lithograph Corp., 952 E. 72d St., Cleveland, Ohio
Kliegl Bros., Universal Electric Stage Lighting Co., 321 W. 50th St., New York, N. Y.
Sperti Electric Mfg. Corp., 424 E. Fourth St., Cincinnati, Ohio
Ultra Violet Products, Inc., 5205 Santa Monica Blvd., Los Angeles, Cal.

LUMINOUS, FLUORESCENT PAINTS

for signboards, instrument dials, panels

Luminous Dials

Etched Products Corp., 3901 Queens Blvd., Long Island City, N. Y.
Grammes & Sons, Inc., L. F., 344 Union St., Allentown, Pa.
O'Hara Waltham Mfg. Co., 74 Rumford Ave., Waltham, Mass.
Premier Metal Etching Co., 21-03 44th Ave., Long Island City, N. Y.
Whittier Co., Horace R., Pequabuck, Conn.

Luminous Paint

American Luminous Products Co., 6420 Marbrisa Ave., Huntington Pk., Cal.
Cook Paint & Varnish Co., Kansas City, Mo.
Cruver Mfg. Co., 2460 Jackson Blvd, Chicago, Ill.
De Voe & Raynolds Co., 44th St. & First Ave., New York, N. Y.
Fluorescent Pigments Corp., 445 W. 41st St., New York, N. Y.
Hammer Laboratories, 624 Monaco St., Denver, Col.
McDaniel Sign Co., Cairo, Ill.
Niteglo Co., 500 Fourth Ave., Joliet, Ill.
Radium Chemical Co., 570 Lexington Ave., New York, N. Y.
Siemon Colors, Inc., 172 Penn Ave., Newark, N. J.
Stroblite Co., 35 W. 52d St., New York, N. Y.
True-Tagg Paint Co., Third & Auction Sts., Memphis, Tenn.
United States Radium Corp., 535 Pearl St., New York, N. Y.

ILLUMINATED SIGNS

for Light Locks

Lamp Coloring

Day & Co., James B., 1872 Clybourn Ave., Chicago, Ill.
Egyptian Lacquer Mfg. Co., 1270 Sixth Ave., New York, N. Y.
Kliegl Bros., Universal Electric Stage Lighting Co., 321 W. 50th St., New York, N. Y.
McGil Mfg. Co., Box 670, Valparaiso, Ind.
McKay Co., 101 Beckman St., New York, N. Y.
Rosco Laboratories, 367 Hudson Ave., Brooklyn, N. Y.

Miniature Incandescent Lamps

Avon Lamp Works, 730 S. 13th St., Newark, N. J.
Bright Star Battery Co., 200 Crooks Ave., Clifton, N. J.
Carlton Lamp Corp., 811 30th St., Union City, N. J.
Chicago Miniature Lamp Works, 1500 N. Ogden Ave., Chicago, Ill.
General Electric Co., Nela Park, Cleveland, Ohio
Herzog Miniature Lamp Works, 12-19 Jackson Ave., Long Island City, N. Y.
Matchless Electric Co., 564 W. Randolph St., Chicago, Ill.
National Carbon Co., 30 E. 42d St., New York, N. Y.
North American Electric Lamp Co., 1014 Tyler St., St. Louis, Mo.
Tripple Mfg. Co., 43 E. Ohio St., Chicago, Ill.
Tung-Sol Lamp Works, Inc., 95 Eight Ave., Newark, N. J.
Westinghouse Electric & Mfg. Co., Westinghouse Lamp Div., Bloomfield, N. J.

NEON, FLUORESCENT SIGNS

for guidance of OCD workers

Miniature Incandescent Lamps

Avon Lamp Works, 730 S. 13th St., Newark, N. J.
Bright Star Battery Co., 200 Crooks Ave., Clifton, N. J.
Carlton Lamp Corp., 811 30th St., Union City, N. J.
Chicago Miniature Lamp Works, 1500 N. Ogden Ave., Chicago, Ill.
General Electric Co., Incandescent Lamp Dept., Nela Park, Cleveland, Ohio
Herzog Miniature Lamp Works, 12-19 Jackson Ave., Long Island City, N. Y.
Matchless Electric Co., 564 W. Randolph St., Chicago, Ill.
National Carbon Co., 30 E. 42d St., New York, N. Y.
North American Electric Lamp Co., 1014 Tyler St., St. Louis, Mo.
Tung-Sol Lamp Works, Inc., 95 Eighth Ave., Newark, N. J.
Westinghouse Electric & Mfg. Co., Westinghouse Lamp Div., Bloomfield, N. J.

Illuminated House Numbers

Arrow-Hart & Hegeman Electric Co., 103 Hawthorne St., Hartford, Conn.
Art-O-Lite Co., 7945 Wellington Ave., Chicago, Ill.
Novelty Lighting Corp., 2480 E. 22d St., Cleveland, Ohio
Peerco, Inc., 1604 S. Crescent Ave., Park Ridge, Ill.
Pryne & Co., 1245 E. 33d St., Los Angeles, Cal.
Reed Electrical Mfg. Co., 239 Fourth Ave., Pittsburgh, Pa.
Scheffler, 293 Ridgewood Ave., Glen Ridge, N. J.

Builders of Signs

Artkraft Sign Co., Jones & Kibby Sts., Lima, Ohio
Art Neon Co., 2565 Curtis St., Denver, Col.
Bellows Claude-Neon Co., 861 E. Tallmadge Ave., Akron, Ohio
Brink, C. I., 147 W. Fourth St., South Boston, Mass.
Claude Neon Lights, Inc., 36-08 33d St., Long Island City, N. Y.
Donnelly Electric & Neon Co., 3190 Washington St., Boston, Mass.
Electrical Products Consolidated, 1020 Virginia St., Seattle, Wash.
Electrical Products Corp., 1128 Venice Blvd., Los Angeles, Cal.
Epstein & Co., Martin, 255 N. Third St., Philadelphia, Pa.
Federal Brilliant Co., 3531 Washingtn Ave., St. Luis, Mo.
Federal Electric Co., 8700 S. State St., Chicago, Ill.
Flashtric Sign Works, 3914 N. Western Ave., Chicago, Ill.
Flexflume Corp., 1100 Military Rd., Buffalo, N. Y.
General Outdoor Advertising Co., Harrison & Loomis Sts., Chicago, Ill.
Industrial Electric, Inc., 3227 Magazine St., New Orleans, La.
Lackner Co., Lackner Bldg., Cincinnati, Ohio
Maxwell Co., R. C., 725 E. State St., Trenton, N. J.
Mobeco, Inc., 452 Pleasant St., Watertown, Mass.
Neon Electric Signs, Inc., 44 E. Hall St., Battle Creek, Mich.
Neon Products, Inc., 1000 Neon Ave., Lima, Ohio
New Jersey Claude Neon Corp., 240 Central Ave., Newark, N. J.
Outdoor Electric Advertising, Inc., 2239 Cedar Springs St., Dallas, Tex.
Quehl Sign Co., 318 Main St., Cincinnati, Ohio
Texlite, Inc., 2840 Factory St., Dallas, Tex.
Walker & Co., 88 Custer Ave., Detroit, Mich.
Wiley, Inc., R. & W., Hertel at Elmwood Ave., Buffalo, N. Y.

Internally Lighted Signs

Acme Lighting Products, 2114 Woodland Ave., Cleveland, Ohio
Belson Mfg. Co., 800 S. Ada St., Chicago, Ill.
Century Lighting, Inc., 419 W. 55th St., New York, N. Y.
C. & P. Electric Works, Shaw Lane, Springfield, Mass.
Day-Brite Lighting, Inc., 5405 Bulwer Ave., St. Louis, Mo.
Display Stage Lighting Co., 617 Tenth Ave., New York, N. Y.
Erikson Electric Co., L., 6 Power House St., Boston, Mass.
Frink Corp., 23-10 Bridge Plaza, S. Long Island City, N. Y.
Garden City Plating & Mfg. Co., 1430 S. Talman Ave., Chicago, Ill.
Gill Glass & Fixture Co., Amber & Tioga Sts., Philadelphia, Pa.
Gruber Brothers, 78 Spring St., New York, N. Y.
Guth Co., Edwin F., 2615 Washington, St. Louis.
Hub Electric Corp., 2219 W. Grand Ave., Chicago.
Kent Metal Mfg. Co., 490 Johnson Ave., Brooklyn, N. Y.
Kirkland Co., H. R., Morristown, N. J.
Klemm Reflector Co., 134 N. Fifth St., Philadelphia.
Kliegl Bros. Universal Electric Stage Lighting Co., 321 W. 50th St., New York, N. Y.
Kopp Glass, Inc., Palmer & Carrie Sts., Swissvale, Pa.
Moran & Hastings Mfg. Co., 605 W. Washington Blvd., Chicago, Ill.
Pickwick Metalcraft Co., 489 Broome St., New York, N. Y.
Rawson & Evans Co., 710 Washington Blvd., Chicago, Ill.
Sunlight Reflector Co., 226 Pacific St., Brooklyn, N. Y.
Switchboard Apparatus Co., 2305 W. Erie St., Chicago, Ill.
Western Sand Blast Co., 2015 Emerson Ave., Chicago, Ill.
Wheeler Reflector Co., 275 Congress St., Boston, Mass.
Willey Sign Co., 1559 Church St., Detroit, Mich.

Neon and Fluorescent Tubing

Chicago Electrode Laboratories, St. Charles, Ill.
Corning Glass Works, Corning, N. Y.
Duro-Test Corp., North Bergen, N. J.
General Luminescent Corp., 732 Federal St., Chicago, Ill.
Hygrade Sylvania Corp., 60 Boston St., Salem, Mass.
Luminous Laboratories, Inc., 6 E. Lake St., Chicago, Ill.
Riedel Glass Works, Inc., Jos., 261 Fifth Ave., New York, N. Y.
St. Charles Technical Laboratories, Inc., 10 State Ave., St. Charles, Ill.

EMERGENCY LIGHTING SYSTEMS

Storage battery systems and engine-driven generating plants

Emergency Lighting Systems

Acme Fire Alarm Co., 36 W. 15th St., New York, N. Y.
Automatic Electric Mfg. Co., 729 S. Front St., Mankato, Minn.
Blitz Electric Co., 5713 Wentworth Ave., Chicago.
Electric Storage Battery Co., Allegheny Ave. & 19th St., Philadelphia, Pa.
McCormick & Co., J. H, Williamsport, Pa.

6- and 12-Volt Lighting Plants

Briggs & Stratton Corp., 2711 N. 13th St., Milwaukee, Wis.
Continental Motors Corp., Muskegon, Mich.
Delco Appliance Div., General Motors Sales Corp., 391 Lyell Ave., Rochester, N. Y.
Electric Specialty Co., 211 South St., Stamford, Conn.
Homelite Corp., 77 Riverdale Ave., Port Chester, N. Y.
Johnson Motors Div., Outboard Marine & Mfg. Co., 1810 Pershing Rd., Waukegan, Ill.
Kato Engineering Co., 539 N. Front St., Mankato, Minn.
Midco Mfg. & Distributing Co., S. 13th & Kentucky Ave., Sheboygan, Wis.
Onan & Sons, D. W., 796 Royalston Ave., Chicago, Ill.
Pioneer Gen-E-Motor, 5849 Dickens Ave., Chicago, Ill.
Sea-Pal Radio Co., 228 N. La Salle St., Chicago, Ill.
Sterling Machinery Corp., 411 Southwest Blvd., Kansas City, Mo.

32- and 110-Volt Lighting Plants

Air-Electric Machine Co., Lohrville, Iowa
Buda Co., 154th & Commercial Ave., Harvey, Ill.
Continental Motors Corp., Muskegon, Mich.
Cushman Motor Works, Lincoln, Neb.
Delco Appliance Division, General Motors Sales Corp., 391 Lyell Ave., Rochester, N. Y.
Electric Specialty Co., 211 South St., Stamford, Conn.
Fairbanks, Morse & Co., 600 S. Michigan Ave., Chicago, Ill.
Fuller & Johnson Mfg. Co., 1350 E. Washington Ave., Madison, Wis.
General Electric Co., Schenectady, N. Y.
Harnischfeger Corp., 4400 W. National Ave., Milwaukee, Wis.
Homelite Corp., 77 Riverdale Ave., Port Chester, N. Y.
Hutchison Engineering Works, 549 Washington Blvd., Chicago, Ill.
Independent Electric Machinery Co., Southwest Blvd. & Central St., Kansas City, Mo.
Kato Engineering Co., 539 N. Front St., Mankato, Minn.
Kewanee Private Utilities Co., Kewanee, Ill.
Knickerbocker Machine Works, 421 Classon Ave., Brooklyn, N. Y.
Kohler Co., Kohler, Wis.
Midco Mfg. & Distributing Co., S. 13th & Kentucky Ave., Sheboygan, Wis.
Moon Mfg. Co., 128 N. Jefferson St., Chicago, Ill.
Mo-To-Rotor Co., Arco, Idaho
Novo Engine Co., Lansing, Mich.
Onan & Sons, D. W., 796 Royalston Ave., Minneapolis, Minn.
Phelps Power & Light Corp., Rock Island, Ill.
Pioneer Gen-E-Motor, 5849 Dickens Avenue, Chicago, Ill.
Pyle-National Co., 1334 N. Kostner Ave., Chicago, Ill.
Regal Gasoline Engine Co., Coldwater, Mich.
Sterling Machinery Corp., 411 Southwest Blvd., Kansas City, Mo.
United States Motors Corp., 420 Nebraska St., Oshkosh, Wis.
Universal Motor Co., 198 Harrison St., Oshkosh, Wis.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

SIRENS AND HORNS

Electrically Actuated Audible Signals

Manual Burglar Alarms

Auth Electrical Specialty Co., 422-430 E. 53rd St., New York, N. Y.
Bellman Burglar Alarm Co., 1922 N. Church St., Rockford, Ill.
Butte Electric & Mfg. Co., 24 Sterling St., San Francisco, Cal.
Connecticut Telephone & Electrical Corp., 70 Britannia St., Meriden, Conn.
Edwards & Co., Norwalk, Conn.
Holtzer-Cabot Electric Co., 125 Amory St., Boston, Mass.
Ostrander Electric Works, W. R., 78 Prince St., Brooklyn, N. Y.
Partrick & Wilkins Co., 51 N. Seventh St., Philadelphia, Pa.
Stanley & Patterson Div., Schwarze Electric Co., Adrian, Mich.

Signal Horns

Auth Electrical Specialty Co., 422-430 E. 53d St., New York, N. Y.
Benjamin Electric Mfg. Co., Des Plaines, Ill.
Connecticut Telephone & Electric Corp., 70 Britannia St., Meriden, Conn.
Edwards & Co., Norwalk, Conn.
Federal Electric Co., 8700 S. State St., Chicago, Ill.
Holtzer-Cabot Electric Co., 125 Amory St., Boston, Mass.
Lake Mfg. Co., 2323 Chestnut St., Oakland, Cal.
Mohawk Electric Mfg. Co., 62 Howard St., Irvington, N. J.
Signal Engineering & Mfg. Co., 152 W. 14th St., New York, N. Y.
Stanley & Patterson Div., Schwarze Electric Co., Adrian, Mich.

Alarm Sirens

Benjamin Electric Mfg. Co., Des Plaines, Ill.
Bullard Co., E. D., 275 Eighth St., San Francisco, Cal.
Butte Electric & Mfg. Co., 24 Sterling St., San Francisco, Cal.
Cooper Company, Clark, 1500 N. Mascher St., Philadelphia, Pa.
Decot, Theodore, Sauk City, Wis.
Federal Electric Co., 8700 S. State St., Chicago, Ill.
General Fire Truck Corp., 2202 E. Jefferson Ave., Detroit, Mich.
H.O.R. Siren Co., 6 Broad St., Stapleton, Staten Island, N. Y.
Partrick & Wilkins Co., 51 N. Seventh St., Philadelphia, Pa.
Sireno Co., 75 Clinton St., Staten Island, N. Y.
Sparks-Withington Co., Jackson, Mich.
Stanley & Patterson Div., Schwarze Electric Co., Adrian, Mich.
Sterling Siren Fire Alarm Co., 56 Allen St., Rochester, N. Y.
Woodhouse Mfg. Co., 17 E. 42d St., New York, N. Y.

Public Address Systems

American Transformer Co., 178 Emmet St., Newark, N. J.
Atlas Sound Corp., 1443 39th St., Brooklyn, N. Y.
Bell Sound Systems, Inc., 1183 Essex Ave., Columbus, Ohio
Bogen Co., David, 663 Broadway, New York, N. Y.
Cincinnati Time Recorder Co., 1733 Central Ave., Cincinnati, Ohio
Couch Co., S. H., North Quincy, Mass.
Electro-Acoustic Products Co., 200 E. Illinois St., Chicago, Ill.
Gates Radio & Supply Co., Quincy, Ill.
Holtzer-Cabot Electric Co., 125 Amory St., Boston, Mass.
Lipman Engineering Co., 415 Van Braam St., Pittsburgh, Pa.
Macy Engineering Co., 1451 39th St., Brooklyn, N. Y.
Miles Reproducer Co., 812 Broadway, New York, N. Y.
Operadio Mfg. Co., St. Charles, Ill.
Oxford-Tartak Radio Corp., 915 W. Van Buren St., Chicago, Ill.
Rauland Corp., 3341 Belmont Ave., Chicago, Ill.
RCA Mfg. Co., Camden, N. J.
Segelsound, Inc., 235 Pine St., Gardner, Mass.
Sundt Engineering Co., 4759 Ravenswood Ave., Chicago, Ill.
Transformer Corp. of America, 69 Wooster St., New York, N. Y.
United Sound Engrg. Co., 2233 University Ave., St. Paul, Minn.
Universal Microphone Co., Centinela at Warren Lane, Inglewood, Cal.
Utah Radio Products Co., 820 Orleans St., Chicago, Ill.
Webster Co., 5622 Bloomingdale Ave., Chicago, Ill.

VENTILATION

Ventilating Fans

Air Controls, Inc., 1941 W. 114th St., Cleveland, Ohio
Airmaster Corp., 4317 Ravenswood Ave., Chicago, Ill.
Allen Corp., 9765 Erwin Ave., Detroit, Mich.
Allied Factories, Inc., 1032 Baltimore Ave., Kansas City, Mo.
American Blower Corp., Detroit, Mich.
American Coolair Corp., 3604 Mayflower St., Jacksonville, Fla.
Autovent Fan & Blower Div., Herman Nelson Corp., 1821 N. Kostner Ave., Chicago, Ill.
Belco Exhaust Fan Mfg. Co., 3810 Olive St., St. Louis, Mo.
Buffalo Forge Co., 508 Broadway, Buffalo, N. Y.
Chelsea Fan & Blower Co., 1206 S. Grove St., Irvington, N. J.

BLACKOUTS

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Circulators & Devices Mfg. Corp., 100 Prince St., New York, N. Y.
Dallas Engineering Co., 2000 S. Akard St., Dallas, Tex.
Dayton Electric Mfg. Co., 511 S. Green St., Chicago, Ill.
Diehl Mfg. Co., Trumbull & First Sts., Elizabethport, N. J.
Dual-Air Fan Co., 2608 Arthington St., Chicago, Ill.
Economy Electric Mfg. Co., 4634 W. 21st Pl., Chicago, Ill.
Electrovent Corp., 5251 Western Ave., Detroit, Mich.
Emerson Electric Mfg. Co., 1824 Washington Ave., St. Louis, Mo.
Exhaust Fan & Blower Co., 53 Park Pl., New York, N. Y.
Fitzgerald Mfg. Co., Torrington, Conn.
General Electric Co., Appliance and Merchandise Dept., Bridgeport, Conn.
Gilbert & Co., Walter B., Sixth Ave. & Yale St., York, Pa.
Gilbert Co., A. C., Blatchley Ave., New Haven, Conn.
Hall Mfg. Co., Cedar Rapids, Iowa
Hunter Fan & Ventilating Co., 92 Warren St., New York, N. Y.
Ilg Electric Ventilating Co., 2850 N. Crawford Ave., Chicago, Ill.
International Engineering, Inc., 1145 Bolander Ave., Dayton, Ohio
Johnson Fan & Blower Corp., 1319 W. Lake St., Chicago, Ill.
Kisco Co., 39th & Chouteau, St. Louis, Mo.
Lau Blower Co., 2001 Home Ave., Dayton, Ohio
Meier Electric & Machine Co., 3525 E. Washington St., Indianapolis, Ind.
Peerless Electric Co., 740 W. Market St., Warren, Ohio
Phelps Mfg. Co., 715 Thomas St., Little Rock, Ark.
Propellair, Inc., Lagenda Ave., Springfield, Ohio.
Reed Unit-Fans, Inc., 811 St. Charles St., New Orleans, La.
Reynolds Electric Co., 2650 W. Congress St., Chicago, Ill.
Shreveport Engineering Co., 1241 Dalzell St., Shreveport, La.
Signal Electric Mfg. Co., 1915 Broadway, Menominee, Mich.
Smith Mfg. Co., F. A. N., Union at Augusta, Rochester, N. Y.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.
Tennison Mfg. Co., Houston, Tex.
Trade-Wind Motorfans, Inc., 5725 S. Main St., Los Angeles, Cal.
Universal Blower Co., 124 S. Woodward Ave., Birmingham, Mich.
Victor Electric Products, Inc., 2950 Robertson Ave., Cincinnati, Ohio
United Blower Co., 193 Centre St., New York, N. Y.
Wagner Electric Corp., 6400 Plymouth Ave., St. Louis, Mo.
Ward Co., Edgar T., 7777 W. Lake St., River Forest, Ill.
Westinghouse Electric & Mfg. Co., 246 E. Fourth St., Mansfield, Ohio
West Wind Corp., Ninth Ave., S., & Grant St., Seattle, Wash.
Wind-Way Fan & Ventilator Co., 862 Camp St., New Orleans, La.

REFLECTORS

Reflector Buttons

Chicago Novelty Co., Marion, Ind.
Grace Mfg. Co., Dallas, Tex.
Lancaster Lens Co., Lancaster, Ohio
National Colortype Co., Bellevue, Ky.
Peerless Mfg. Corp., Louisville, Ky.
Persons-Majestic Mfg. Co., Worcester, Mass.
Star-Lite Co., 312 E. Market St., Indianapolis, Ind.
Vitralux Corp. of America, 30 Rockefeller Plaza, New York, N. Y.

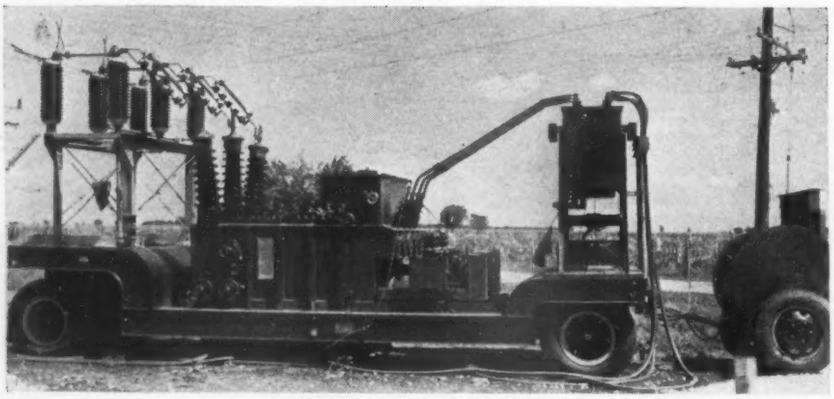
Blackout Screen Paper

Andrews & Co., John T., Penn Yan, N. Y.
Angier Corp., Framingham, Mass.
Barber Asphalt Corp., Barber, N. J.
Barrett Co., 38 Rector St., New York, N. Y.
Beloit Box Board Co., Beloit, Wis.
Bicking Paper Mfg. Co., S. Austin St., Dowington, Pa.
Bird & Son, Inc., East Walpole, Mass.
Certain-Teed Products Corp., 100 E. 42d St., New York, N. Y.
Cincinnati Industries, Inc., 520 Station Ave., Lockland, Cincinnati, Ohio
Cromwell Paper Co., 4815 S. Whipple St., Chicago, Ill.
Diem & Wing Paper Co., Lock & Eggleston Aves., Cincinnati, Ohio
El-Rey Products Co., 1633 N. San Pablo St., Los Angeles, Cal.
Fleming & Sons, Inc., 1116 E. 12th St., Dallas, Tex.
Fox Paper Co., Lockland, Cincinnati, Ohio
Johns-Manville, 22 E. 40th St., New York, N. Y.
Nelson Mfg. Co., B. F., 401 Main St., N.E., Minneapolis, Minn.
Newton Paper Co., Holyoke, Mass.
Simplex Paper Corp., 1935 Severance St., Adrian, Mich.
Wood Conversion Co., First National Bank Bldg., St. Paul, Minn.
York Paper Mfg. Co., York, Pa.

Mobile Substation in Use Two-thirds of the Time

Fourteen months operating record on Illinois utility system — Unit makes possible wide range of work without interference to service — Company buys two more for divisions

J. D. ROBERTS, Central Illinois Public Service Company, Springfield*



ONE OF TWO newest mobile substations as used to bypass completely a 66,000/11,000-volt, 600-kva., substation

DURING its first fourteen months of regular service the original† 1,500-kva. mobile substation placed in service on this system early in 1940 has seen 5,776.5 hours of service out of a possible 9,424, corresponding to an operation factor of 63.5 percent. During this period the 15¾-ton, trailer-mounted unit traveled 1,089 miles, spending 156 hours, or 2.61 percent of its service time, on the road.

Perhaps most interesting to utility operators, however, is the class of work made possible without service interference by the apparatus, which is rated at 66,000/33,000-2,300/4,600/6,900/11,900 volts Y. Of the seventeen jobs in the period covered, nine involved changes in substation transformer banks, two involved relocation of transformers, two line clearance for transmission construction. The remaining four were isolated operations, ranging from switch repair to supplying temporary service to a U. S. Army air field during substation construction. Complete operating record appears in the accompanying table.

Record of Mobile Substation Use

Location	Purpose	Date In	Date Out	Hours in Service	Miles Traveled	Hours Traveled	% Travel Time to Service Time
Rantoul	Build substation for Chanute Field	4/ 4/40	6/ 4/40	1,464	120	18	1.23
Charleston	Change 66-kv. bank & 2.3-kv. feeder	6/ 6/40	7/ 9/40	750	26	4	0.50
Grayville	Change 66-kv. bank	7/11/40	7/20/40	216	195	24	11.1
St. Elmo (oil field)	Change bank	7/24/40	8/ 2/40	208	45	7	3.36
Windsor	Change bank	8/21/40	8/21/40	8	24	5	62.5
Arcola	Change bank, install step regulator	8/23/40	9/ 5/40	156	23	5	3.2
Tuscola	Change bank, install 33-kv. air-break switches	9/ 6/40	10/29/40	792	23	4	0.50
Pana	Change bank, install cable and step regulator	10/30/40	11/12/40	288	56	8	2.8
Assumption	Change bank	11/13/40	11/15/40	36	36	6	16.6
Albion	Change system voltage to 12 kv., repair 66-kv. line	11/20/40	12/11/40	420	156	28	6.66
Paris	Move 66 to 12-kv. bank for Hoopeston 66-kv. line bay	12/13/40	12/31/40	420	42	8	1.9
Paris	Move 66-kv. to 12-kv. bank to make room for Hoopeston line bay	12/13/40	1/10/41	420	42	8	1.9
Paris	Repair 66-kv. air-break switches and station bus work	3/22/41	3/22/41	8	0	0	....
Mattoon	Remove three 2,000-kva., 66,000 to 33,000-volt transformers and install three 5,000 in the interchange bank	4/13/41	4/13/41	6½	58	4	61.51
Bridgeport	Clear 11.9-kv. line from Lawrenceville for rebuilding	4/29/41	5/ 2/41	80	85	7	8.75
Bismarck	Clear 6.9-kv. line for construction of Paris-Hoopeston 66-kv. line	5/ 5/41	6/ 3/41	670	158	16	2.39
Paxton	Install 33-kv. oil switches	Moved to Paxton for this purpose, but not used.					
		6/ 4/41		35	0	4	11.41
		Total		5,977½	1,089	156	2.61

Now Two More

Since constructing its first mobile substation the company has added two more, so that each of the three operating divisions within the company's property now has one available for general substation maintenance, changes of equipment and as spare apparatus in the event of failure of substation equipment under emergency conditions.

*Chief engineer.

†See "Electrical World," May 4, 1940, page 55.

The two newest substations, which cost $17,000 complete and ready for use, are of 2,000 kw. capacity, and differ in some respects from the original design. Transformers constructed by Westinghouse are a horizontal-coil type with forced oil circulation, 66/33 kv. to 11.9 kv. —Y, 6.9 kv. delta, 4,400 volts Y and 2,300 volts delta. These voltages are all obtained through the medium of external manually operated no-load, no-voltage tap changers. Motor for operating the forced oil, circulating pump is supplied from two small service transformers having voltage taps corresponding with the low-voltage ranges of the main transformer.

High-Speed Mobility

The 15,000-volt, 50,000-kva., 600-amp. secondary Roller-Smith oil circuit breaker has induction overload relay protection. Transformer primary windings are supplied through Royal air-break switches and S&C liquid fuses.

Equipment is mounted on a spring-mounted eight-wheel Jahn trailer with pneumatic tires. Wheelbase is 20 ft. 5¾ in., 5 ft. 8 in. track. Over-all height loaded is 12 ft. 4 in., sufficient to pass readily under viaducts and underpasses on the Illinois highways.

Mobile in all respects, the new units are arranged for attachment directly to the rear of a 2½-ton substation truck and can travel on improved roads at a maximum speed of 35 miles per hour. No special permits for the use of the highway are required, since this substation is within the highway restrictions of loading and length.

Three 250-ft. lengths of special high-voltage cable for the unit are carried in a separate four-compartment Jahn cable-reel trailer visible in the accompanying illustration, which shows the mobile unit used to bypass completely a 66/11-kv. 600-kva. substation.

Fencing

Ordinarily protective fencing is not required in the normal use of the substations, since they can in most cases be taken within substation fences and inclosures. However, when conditions require separate fencing the substation truck is equipped with folding slat rolled fencing, which can be quickly unrolled and installed around the substation in exposed locations.

War Effect on English Electric Service

Air raid experience shows electricity supply less affected by air raids than had been anticipated — Search for substitute materials meeting success

ERIC HARDY

BEYOND the usual wartime difficulties of obtaining labor and materials, there has not been in England anything like the expected breakdown or even handicapping of electricity services that was expected from pre-war conception of effects of air raids. Indeed, in the town where this article was written, I have been through about two hundred air raids, with one big blitz lasting eight nights in succession, but in no single instance has the electricity supply of the town been put out of operation.

There have been only isolated and temporary instances of a few houses being without electricity for a day after a raid. To the citizens whose window glass has been shattered by bomb blast and who are forced to use artificial light all day because rooms are darkened by boarded-up windows, the local utility allows a rebate on electricity charges.

The work I have been doing in the electrical industry has largely been in meeting shortages of certain materials. For instance, the shortage of insulating materials has in some cases been met by the use of peat. The peat fiber is treated in a process which produces a material of very low electrical conductivity. Porcelain is, of course, the mainstay of our insulator industry, based on good deposits of English clay. For low-voltage insulation recourse has been had to stoneware and to steatite.

Economy in material has become the order of the day, but there is no lessening of efficiency and safety. The "looping-in" system of wiring is being replaced by the "teeing-off" system. The use of flexible pendants is being restricted. Many individual light switches are being replaced by one switch-control per sub-circuit. The three-month life of temporary installations is being extended to three years with an overhaul at intervals. The final sub-circuit leading in these temporary installations is being increased above the limit of 1,000 watts. A considerable number of the varied models of certain electrical accessories are being cut down to avoid wasting material—it has been considered that a pre-war production of 150 different types of but three sizes of household switches is wasteful in wartime; likewise, 140 different models of switch plugs, 175 styles of lampholders, and so on.

Illumination Studies

In factories installations are aiming to arrange controls and wiring to give maximum flexibility to meet the changing conditions and changing layouts of machinery, as new war work brings changed methods of production.

Illumination conditions are being improved. Many lighting problems that have arisen in civil defense are being studied by the Illuminating Engineering Society, which is assisting the government's Ministry of Home Security in the matter. Twenty-four subcommittees have been at work, using the services of 100 members of the society, to study the behavior of eyes at very weak illumination. They have devised new measuring apparatus. They have been checking up on the weak "starlight" electric illumination used in the streets of some of our cities during blackout. The society is making research into the visibility of objects viewed from above during the blackout, in order to see how far blackout restrictions can be relieved.

Editorials

S. B. WILLIAMS, *Editor*

The Power Supply Situation for the New Year

DECEMBER, the peak month, has come and gone without creating a bit of trouble in load service. In fact, the output of the peak week was disappointing, in view of earlier predictions. Its increase over the peak week of 1941 was less than 400,000,000 kw.hr., or 13 per cent, while the change over the preceding week, generally sharp, was very small. In fact, a study of the weekly output chart as it appears in ELECTRICAL WORLD will show signs of deceleration.

There will, however, be areas where load will continue to increase, but on the whole, provided of course the government maintains the program it now appears to be working on, it would be surprising if the 1942 noncoincident peak for the country as a whole exceeded the 1941 peak by more than a very few percent.

There are certain facts which cannot be denied. The first is that war, more so now than twenty-five years ago, so alters a nation's economy as to curtail over-all power peaks. Twenty-four-hour, seven-day-week industrial operation increases kilowatt-hour consumption, but it does not increase demand. Conversion of production from peace products to war products again does not alter demand, but a great many plants that cannot be converted and which cannot get materials for normal production will have a materially reduced demand. The Army is to be increased considerably. That means lowered home consumption of electricity.

If to these are added blackouts during the peak month we have more reason than ever to believe that fears of inability to meet 1942 power demands, except for isolated areas, will not be realized.

It is possible that an extension of daylight saving as asked for by the President may also be beneficial in holding down the peak. With industrial load on long hours there is some question, however, whether daylight saving will save very many kilowatts, as has been claimed for it. It will, of course, save kilowatt-hours, but except for cases of water shortage there has been no call to cut down on consumption. If fuel supply were short, then, of course, daylight saving, as in the last war, would be very effective.

The December peak appears to have reduced the available capacity reserve by nearly 600,000 kw., or from 24 percent to 21 percent above the noncoincident demand. This would appear to be a reasonably safe condition if our premises that demand will not increase greatly are correct, especially since there will be some substantial additions to capacity during the year.

At the moment the important thing is not how to increase this reserve, but how to use it to help out areas that may be deficient in reserve. Lines to interconnect the "have" and "have not" areas will have to be built, and since OPM will have the final voice in copper allocation it would seem advisable for the industry to take the initiative in asking for some sort of joint planning whereby only that will be built which must be built and that such lines may be engineered with proper copper economy.

There should be no large power shortage in the United States if the power now available is properly used.

Blackout Protection Supplies

PART of the confusion with regard to blackout protection against night bombing is due to the lack of material and products suitable for that purpose. And part of the reason for the lack of those materials is due to the fact that nobody knows exactly what is wanted or needed. Because of this condition, and also because the electrical industry was being called on to supply that information, we have compiled and are publishing in this issue a list of manufacturers classified by products that appear to have some relation to the problem. Very few of these manufacturers are making products specifically for blackouts, but until something more official comes out they are probably in the best position to give assistance to the industry.

A word of caution. Hysteria should not be allowed to defeat the benefits of methodical planning of protective measures. Runs on producers and dealers should be prevented and not be allowed to swamp the suppliers and prospective fabricators of the requisite equipments. In fact, the present programs may be substantially modified by our own American tests and by the realization, apparently already gaining acceptance, that total blackout is often less effective than the creation of deceptive patterns. At any rate, the products which might possibly be obtained through certain of the manufacturers enumerated in this list are, in many instances, of such nature as to assist in checking any public disposition to go all-black uselessly rather than adopt shields, masks, light-locks, dimmed sources, etc., so as to be able to live a nearly normal life with safety.

It is to be hoped, however, that this confusion will not continue for long. Somebody in authority should decide quickly whether we are going to have blackouts or brownouts, and where and under what conditions. Blue lights, for instance, have been found by Army test to have greater visibility than white lights, and therefore should not be used. Nevertheless, the run on these lamps

and filters has been large. In one city anything but small blue lights would be declared by ordinance illegal for residence lighting.

There seems to be far too much disorganization in this phase of civilian defense. Unless this is cleared up promptly, we may find ourselves in a bad situation if an air raid should come.

Deferred Research

ONE immediate consequence of intensified war activity is the temptation to defer developmental research on the part of both producers and users of equipment. Pressure for changes away from peacetime production, absorption of technical staffs in defense developments and the search for substitute materials, as well as for simplification, undoubtedly make it unfeasible at the moment to continue many otherwise meritorious research projects. This is most unfortunate in so far as studies promising immediate results are concerned, and almost as much so with regard to longer-range developments.

There is no dearth of techniques and providing equipments which, if further perfected, would move further toward economical reliability. On the side of thermodynamic equipment we need to know more about control of turbine-blade deposits, about circulation in boilers, about accelerated heat interchange and reduced heat loss, about factors conducive to decreased erosion of fan blades, about the chemistry of corrosion retardation, about adhesiveness of ash and slag.

On the electrical side there is the call for insulations that will stand higher dielectric temperatures (more academically perhaps), for study of the reaction of magnetic and dielectric fields within generators and transformers, for non-destructive tests for condition of generator insulations, for more knowledge of what really makes cable insulation deteriorate with successive loadings, for simplification of joints of cable, for instruments that will give a better picture of abrupt and short-duration loads. It may take superlative imagination, but could there not even be some synthesizing instrument to give a continuous index of the over-all efficiency of a whole generating station; the controls exist and they are trusted, but the result attained now comes from laborious analysis of logs.

More immediate are such matters as simple, ready means of locating faults on networks, equally simple means of banking distribution transformers so the marginal capacities there can contribute to economy and reliability, just as they are utilized in the higher voltage interconnections. All along the line there is call for standardization, particularly the kind that gets down to fewer ratings, fewer dimensional differences and fewer individualistic departures.

While all these have meaning for the long-range future, most of them also have a bearing on the exigencies of the immediate present, especially in the speed-up by which democracy pays for the privilege of being oblivious to the diabolical machinations of tyrants.

Power Plant Bomb Protection

MOST central stations are now taking steps to "blackout" effectively during an air raid and the utilities can be relied upon to do a good job in this respect, but blackout precautions are comparatively simple compared to the development of protective measures inside the plant itself should a direct hit be made by a bomb. One has only to imagine the results of a destructive explosion in the main electrical switchroom of a large plant. Consideration, therefore, might be given to multiple circuits for essential services so that outage may be limited to the short time needed to change over connections. Or suppose one of the large boilers is struck, how can the remaining boilers be protected from injury? This may mean some sectionalizing of the boiler plant. Steam turbines, while not so liable to direct hits, may be damaged by flying fragments. What protective devices can be installed to avoid this occurrence? Thought must also be given to the protection or isolation of fuel oil, gas and water lines in and about the station.

British utilities have had considerable experience with bombing and its effects and are said to have developed effective protective measures. It is hoped that this information can be made available at least confidentially to our American central stations.

Keep 'Em Lighted and We'll Keep 'Em Flying

NOT ONLY IS WAR taking its expected human toll on the battle front but on the home front as well, killing and maiming workers in a totally unexpected way. Moreover, if the President's request for 24-hour, seven-day week production can be complied with the slaughter will be worse. We are referring to the mounting accident record for highways leading to and from defense plants.

Two streets in Hartford, Pitkin and Main, take most of the traffic to and from the plants of United Aircraft and Hamilton Standard Propeller. As employment increased the traffic accidents on these two streets grew. And then modern street lighting was installed.

Ten months later, when daylight traffic had increased 22 percent, but because of extra shifts night traffic on these two streets had trebled, the day accidents rose 175 percent and the night accidents but 32 percent.

Had the lighting of these two streets not been improved the night accidents would have risen as fast as or faster than the day record because of greatly increased traffic, and many a plane that is now helping our Army and Navy avenge Pearl Harbor would not have been built.

These are the days when every American is probing himself to discover what he can best do to hurry the final victory. To the utility street lighting man comes a special opportunity of lighting for maximum safety the roads that carry our workers to and from the plants that make our planes, our tanks, our battleships.

These are the highways to victory—keep 'em lighted and we'll keep 'em flying.

Washington Comment

By GEORGE E. DOYING, Jr., Washington Correspondent

War Begins to Pinch

RECENT EVENTS in Washington foreshadow for the year just beginning cataclysmic effects upon the American way of living.

A nation which has tightly tied its economy and its everyday life to the rubber tire and the automobile is now faced with a certainty of having no more of either, for months and maybe several years to come.

A nation which has become accustomed to eating a considerable portion of its food from tinned containers is now faced with the virtual certainty of having to revive the glass jar and, perhaps, a modern counterpart to the cracker barrel.

A nation which has learned the labor-saving short cuts of a multitude of household appliances is faced with the probability that production of many of these commodities will soon dwindle to a mere trickle, or cease entirely.

These are some of the things which have begun to take definite shape in the last two or three weeks. The handwriting on the wall isn't quite so clear for other, and equally drastic, alterations in the mode of living which also are on the way. In short, 1942 seems destined to bring to reality in this country many of the sacrifices in comforts of modern living which have visited other nations, ally and enemy alike, already in this war, but which, while talked about for months, have never quite seemed likely to happen here.

Rubber and Tin

Washington's plans are being predicted upon the unglossed-over reality that the United States may be a "have not" nation for an uncertain time to come as regards rubber, tin and other similar resources which come in bulk from the Far East.

Without attempting to cite detailed figures, which are no longer obtainable, it can be stated that the rubber stocks in this country are sufficient to last about a year without any curtailment. Effect of the conservation programs which have been inaugurated recently to stretch rubber supplies will be to double, at least, the length of time the war machine can be fed. Before then enough synthetic capacity can be available to extend the deadline still longer.

Rationing Programs

A similar situation prevails with respect to tin as to supplies on hand and as to prospects for getting more. A tin smelter being built in Texas will be ready later this year to reduce enough Bolivian ore to supply about one-fifth the normal annual consumption, which means it can help make the stockpile last longer but cannot replace it.

Not all rationing programs of civilian commodities will be dictated by potential or actual military losses cutting off natural resources, however. The tire-rationing program is only indirectly responsible for the plan to shut down automobile production at the end of this month.

The driving spirit behind this move is to make more of the nation's productive capacities available for war output—the "get more with what you have" slogan discussed on this page two weeks ago. Since then, the official "victory program" has been set at 56 billions of dollars expenditure in the fiscal year beginning next July 1, and more than 60 billions in the fiscal year after that.

To attain anything like this goal, Washington is going to have to commandeer whole industries. The automotive plants are but the first, because they are the easiest to convert, inasmuch as the Army needs thousands of motorized vehicles. A number of electrical appliance industries are likely to be similarly converted, if not *in toto*, at least all except one or two plants.

The idea of integrating major civilian industries to pool the bulk of their facilities for war output and leave to one or two plants the job of turning out minimum quantities of a "Victory" model as trustees for all the industry is catching hold in Washington. The British have come to this in several lines of durable goods output and the argument advanced for it is that economies of mass production can be salvaged if output is concentrated in a single plant which can be kept operating at a high rate.

In the automotive industry the "break-even" point was fast approaching, probably would have arrived with the original quotas for this month—quotas now increased to clear the factory floors of inventories. So far, quotas set for other durable goods lines have not been nearly so drastic, but the trend is distinctly toward progressive paring down of output. It seems inevitable that the "break-even" point in operations will be reached in a number of other industrial fields before this year is out.

Supply Responsibility

An apparently unrelated step in the making in Washington may have its effect upon this trend. A new defense agency roughly equivalent to a "Ministry of Supply" is being ardently sought by many of the business men and a number of the New Dealers with leading roles in the defense hierarchy. This agency, to which the name of Wendell Willkie has sometime been attached, would have final authority over all procurement for the war effort—for the Army, Navy, lend-lease, Maritime Commission, etc., each of which now does its own buying and plant expansion contracting independently.

Neither the Supply Priorities and Allocations Board nor OPM ever has had authority to let contracts, and too often programs approved by the defense officials have taken weeks—even months—to get translated into formal contracts. The service branches, quite naturally, are violently opposed to losing their contracting authority, but the President is known to be giving serious study to some sort of centralized procurement agency.

If this materializes under civilian, as opposed to military, direction, the procurement agency might well take an active hand in the matter of converting civilian industries *in toto* to war production.

NEWS OF THE WEEK

Home Blackout Procedure Demonstrated by Utility

Buffalo company arranges model room on main sales floor to show equipment necessary and how to prepare blackout quarters — Expensive equipment not necessary

A model room, typical of the way Buffalo citizens will arrange their homes in case of air raids, and set up with necessary equipment to have on hand during a blackout, has been installed on its main sales floor by Buffalo Niagara Electric Corp. Its purposes will be to illustrate to customers what equipment they should have on hand and how to prepare the quarters they expect to occupy during an all-out blackout. The exhibit will be open daily, from 9 a.m. to 5 p.m., and will be manned by trained lighting advisers, who will show housewives just what to do to make certain that the rooms they select are properly equipped to meet all expected demands.

Basically, the main problem of the housewife in times of air raids will be to keep interior illumination from showing outside. Householders who visit the exhibit will receive detailed information on their particular blackout problem. If the home is equipped with shades, drapes or venetian blinds, the treatment for preventing light from spilling out varies. Expensive corrective equipment is not necessary, the company states, for the use of old draperies, black paper, wrapping paper or heavy cloth properly placed can make the room light-proof with little or no expenditure. Defense officials are emphasizing that it is not necessary for householders to purchase any expensive equipment to effect a suitable blackout, it was said, as materials readily found in the home can be adapted for effective blackout material.

General rules being offered the public for blackout preparations are:

1. The area selected to be blacked out should be in easy access to toilet and cooking facilities, and, in case of a blackout of long duration or during the time of meal preparations, auxiliary cooking equipment should be provided.
2. If danger of bombing becomes imminent, shelter under a heavy table affords good protection.
3. Make certain that lights are turned out in all rooms that are not properly screened.
4. Be sure that all outside lighting, such as yard illumination, and garage lights are out.
5. Pull down all shades.
6. It is not necessary to sit in the dark in the "emergency room" if windows are properly blacked out.
7. Lamps should not be placed next to windows.
8. Strong light should be kept off ceilings by cutting down indirect lighting of lamps.
9. Bridge lamps should be equipped with baffle plate and silver bowl type bulb.
10. Pin-up lamps should have reflectors removed and dark papers adjusted over the silk or parchment shade. This can be done through a simple arrangement with black paper and clips.

BLACKOUT HEADQUARTERS AT BUFFALO—Model room (at left) prepared by Buffalo Niagara Electric Corporation to show customers the equipment needed and how to use it. At right, girls of the company's home-lighting bureau use inexpensive paper and muslin to shield window. Note particularly clips on blackout shade, portable radio, candles, coffee maker, blackout bulletin, night light, use of silver bowl lamps, games and cooking equipment.

NORTHWESTERN ELECTRIC CHRISTMAS—A half ton of groceries for Portland's needy was collected by employees of Northwestern Electric Co., Portland, Ore., cooperating in the annual "Sunshine" drive of the local police department. In the picture are (left to right) Ruth Tollenaar, executive department; W. J. Dennis, assistant general manager; J. M. Vorhies, general superintendent's office; Jean Dawson, engineering department

11. When shades are pulled, plug-in night lights are ideal to create a path of light along the floor without causing objectionable light through windows.
12. A supply of candles should be on hand in case of temporary power interruption.
13. A supply of large wood matches should be obtained.
14. Check over flashlights and see that bulbs and batteries are in working order.
15. A radio should be located in the "emergency room" to receive necessary official report.
16. Flashlight beams should not be directed toward windows or ceiling.
17. Stay away from windows. Do not peek out—a flash of light can be easily seen by the enemy.
18. If, for any reason, any member of the family must leave the house, turn out all lights before permitting exit. The same procedure should be followed before admitting any person.

The program has been reviewed by police and defense officials who visited the display. The police commissioner of Buffalo urged that householders take advantage of the opportunity of learning at first hand, and now, just what they can do to make their homes safe for the blackout. "With a little ingenuity and the following of these practical suggestions householders can easily arrange their own blackout preparations at little or no expense," he said.

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Second 183-Mile Line Allotted $2,319,400

Announcement has been made by Paul J. Raver, Bonneville Power Administrator, that a second 183-mile, 230,000-volt transmission line from Grand Coulee Dam to the Bonneville substation near Covington, Wash., will be constructed as soon as steel can be secured. Dr. Raver said an immediate allocation of $2,319,400 had been made for the line and its total cost will be approximately $4,500,000.

One 230,000-volt line, now being constructed between Grand Coulee Dam and Covington substation, will be energized in June.

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Power Curtailment Officially Canceled

OPM's Southeastern power curtailment program was officially canceled this week. Revocation of the limitation order by Priorities Director Nelson ended the mandatory pooling of generating facilities by utilities in eight states; freezing of industrial power consumption and the blackout of nonessential lighting had been lifted earlier.

As a result of heavy winter rains, storage reservoirs in the area now have reached a level which assures continued power supply during the winter season, Power Chief J. A. Krug reported to Nelson. In revoking the order, Nelson thanked utilities for sharing in what he termed an "outstanding achievement" and both he and Krug wrote utilities urging them to continue pooling of generation on a voluntary basis to the extent necessary to assure a complete filling of reservoirs—primarily by continued capacity operation of steam plants.

NEWS BRIEFS

NOW IT CAN BE TOLD that certain power companies in North Carolina were ordered by Army generals to release water from storage dams so that pontoon bridges could be thrown across streams instead of dry river beds. At that time the utility companies were conserving water at the direction of OPM to alleviate drought conditions. While one of the generals was talking it over, the "enemy" slipped across the dry bed and captured his entire force.

FORTY-TWO MERITORIOUS SERVICE CERTIFICATES were awarded last year to employees of the Consolidated Edison Company of New York for services involving life saving and protection of property. Thirty-three of the certificates went to employees who saved persons from drowning, fire, explosions and asphyxiation.

ENGINEERS AND EXECUTIVES of the commercial and industrial departments of Nebraska Power Co. have extended an invitation to business men in the communities served by the company to call on its departments for all possible assistance on priority questions. The company is well posted on procedures and authoritative sources of information.

REVENUES FROM THE SALE of electric energy from Boulder Dam and power plant since June 1, 1941, have been sufficient to warrant the making of initial payments in accordance with the Boulder Canyon Project Adjustment Act of $300,000 each to the states of Arizona and Nevada, and of $500,000 to the Colorado River Development Fund.

HEAVY WATER (deuterium oxide) is a good constituent to have in standard cells. The Bureau of Standards says it gives the cells remarkable constancy in the early part of their service life, an interval in which ordinary cells fluctuate while gravitating to an equilibrium value of voltage.

LOW-COST HOMES, coming within the $6,000 limit imposed by the government, will be featured in the sixteen comprising the 20th annual Home Show at Milwaukee in 1942. Homes will generally have a living room, two bedrooms, bath and kitchen.

CONSOLIDATED OF BALTIMORE recently surveyed 1,400 defense project homes and found the average number of outlets to be eight, ten below certification standards, and, even more significant to utilities, five below the priority order maximum number permitted.

Northwest Companies to Merge Resources for War

Executives of nine large interconnected utilities inaugurate plans for mutual aid in emergencies, to include public power projects and municipal enterprises

Looking toward the general strengthening of all of the power resources in the five states of the Pacific Northwest under war conditions now being faced, the heads of nine of the larger utility companies in the interconnected power grid in the region met in Portland December 29. As a result of this conference, any war emergency will find the companies better organized to give each other prompt aid in the form of power supply, equipment or construction and repair crews.

Plans for extending the existing power interchange and mutual assistance program to include the Bonneville-Coulee system were among important topics considered at the meeting. Dr. Paul J. Raver, Bonneville Administrator, assured representatives of the group that his organization would work actively toward the full co-ordination of resources and facilities to back up the nation's all-out war effort.

Gain 100,000 Kw.

Engineers have estimated that 100,000 kw. of effective capacity can be gained from existing installations through the complete pooling of private, municipal and federal power in the region.

Steps were also taken to bring into the general program, for mutual protection against war hazards, the city light departments of Seattle, Tacoma, Eugene and other substantial municipal power enterprises in the several states.

The plan contemplates taking inventory of man-power, transportation equipment, such as trucks and cars, and surplus supplies of materials and apparatus kept on hand for repairs, so that each operating unit may know promptly the possible sources for securing aid in the event of serious emergency on its system.

The meeting developed that among the 10,000 larger industrial customers on the 16,000 miles of transmission lines forming the main arteries of the interconnected grid are many engaged in the production of war materials and scores of airports, army camps and other defense establishments.

Largest use made of the 8,000,000,000 kw.-hr. produced annually by these interconnected companies is for the production and recovery of war metals, including copper, zinc, lead, antimony, vanadium, cadmium and chrome. Largest single power users are among the nation's biggest copper producers in Montana and Utah.

The eleven companies combined have an army of 13,000 trained employees and a fleet of nearly 2,000 motor vehicles.

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Eicher Resigns from SEC; Gets Federal Judgeship

Once again the chairmanship of the Securities and Exchange Commission has become the steppingstone to a federal judgeship. President Roosevelt has nominated SEC Chairman Edward C. Eicher, onetime Iowa congressman, to succeed Chief Justice Alfred A. Wheat of the District of Columbia Federal Court, who resigned.

Successor to Mr. Eicher has not been named, but there are indications that if the President follows the practice of his last two appointments to the commission—of promoting a staff division chief—Robert H. O'Brien will be elevated to the vacancy. Mr. O'Brien is chief of the Public Utilities Division. It appears probable also that Commissioner Ganson Purcell, first of the staff members promoted to the commission bench, will be the new SEC chairman.

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Priorities Granted Household Repairs

Priority assistance to insure a continued flow of plumbing, heating and electrical supplies for household repairs through regular wholesale and retail channels was made available this week by Priorities Order M-67.

Manufacturers of such supplies are directed to file for priority ratings to obtain needed raw materials on form PD-25-a, the same form as used in the Production Requirements Plan. They can get ratings, however, without a showing that their products are for delivery to defense users.

Supplies, retailers and wholesalers stocking such items, under M-67, are limited in the amount of supplies they may keep on hand. In the eastern part of the country this limit is twice the monthly average sales of such supplies in 1941, while in the western half of the country it is three times the monthly sales.

TO COPE WITH EMERGENCIES—Utility heads of interconnected Pacific Northwest systems who conferred in Portland reviewing wartime responsibilities and laying plans for mutual assistance in the form of power supply, equipment and man power. LeRoy A. Grettum, president Eastern Oregon Light & Power Co.; Franklin T. Griffith, chairman of the board, Portland General Electric Co.; Paul B. McKee, president Pacific Power & Light Co.; Frank Bird, president Montana Power Co.; K. M. Robinson, president Washington Water Power Co.; Z. E. Merrill, president Mountain States Power Co.; A. S. Cummins, president California Oregon Power Co.; C. J. Strike, president Idaho Power Co.; James H. Polhemus, president Portland General Electric Co., and L. T. Merwin, president Northwestern Electric Co.

War Program Governs Public Power Budget

One-third of a billion dollars proposed for hydro-electric power construction — REA allotments cut, but no decrease in operating budgets of REA, SEC and FPC

The war program is at least temporarily dictating the public power spending program of the Administration. This is disclosed by the President's budget recommendations to Congress this week, which carry nearly one-third of a billion dollars for hydro-electric power construction, but propose slashing Rural Electrification Administration's lending activities to one-tenth the current year's rate.

Expenditures proposed for hydro projects by the various government agencies are roughly comparable to amounts set up for the same purpose in the fiscal year ending next July 1. REA, which has $100,000,000 lending authority for this fiscal year, is allotted only $10,000,000 by the President for the next fiscal year "in view of the anticipated curtailment of rural electrification activities because of priorities on materials."

Administrative expenses for REA, however, are continued at nearly the current rate—$4,013,798 for fiscal 1943, compared to $4,262,375 in fiscal 1942. A cut in Electric Farm and Home Authority administrative expenses from $600,000 to $402,150 in the new budget similarly reflects anticipated curtailment in such lines.

Biggest electric power budget proposed by the President is for Tennessee Valley Authority, which is allotted $136,100,000 from the Treasury to meet expected expenditures of $145,000,000. The current year's appropriations totaled $166,800,000, but expenses will be only about $145,000,000. TVA's budget indicates it has "given up" the fight with Senator McKellar for authority to build Douglas Dam. In the $118,317,000 set up for construction are funds for the substitute projects Mr. McKellar advanced for the French Broad development. TVA's biggest spending will be at Kentucky, Fort Loudoun and Fontana dams, these three taking $73,000,000.

An appropriation of $22,750,000 is proposed for Bonneville Power Administration, plus another $4,166,000 to Army engineers for construction. Bonneville got $52,858,000 this year, but $30,000,000 was for a major transmission line network.

Bureau of Reclamation's total budget is $84,551,000, an increase of $8,000,000, mostly for multi-purpose project construction. Grand Coulee is listed for $19,175,000, Central Valley for $48,769,000 and Colorado Big Thompson for $4,830,000, among others. Army engineers are allotted $93,013,798, slightly less than this year, for flood control construction, which will emphasize projects with power features.

Neither of the government's administrative agencies in the power utility field suffered any budget pruning. The Securities and Exchange Commission budget of $5,440,000 is identical with its current appropriation. Federal Power Commission is listed for an increase from $2,808,250 to $3,095,270, mostly due to hiking the defense activities fund from $285,000 to $519,255.

CAMBRIDGE ELECTRIC CHRISTMAS—For the seventh time the employees of the Cambridge Gas Light Co. and New England Gas & Electric Association carried out their annual Employees Christmas Basket Fund on December 24, for the benefit of 74 poor families on the system. The entire enterprise was run by employees "on their own"

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Avoid Blue Light for Blackouts

To prevent further costly mistakes in the use of blue light for blackout, General Electric Co.'s Nela Park engineering department in a statement to lighting equipment manufacturers last week warned that it is questionable whether color has any outstanding advantage over white light of sufficient low intensity for blackout purposes. Contrary to common belief, the statement declared blue light has been proved to be the color most readily detectable when viewed from the air.

Researches have established the fact that reddish or perhaps white light serves best for seeing under low levels of illumination, such as are required for blackout, and is at the same time least likely to be detected from the air, while blue is most conspicuous.

A dimly lighted red area, the statement pointed out, is normally detected by an observer only when he is looking directly at it, while on the other hand the same area dimly lighted with blue is easily detected out of the corner of the eye. For very low levels of illumination red is the only color that retains its distinctive hue; yellows, blues, greens and other colors all tend to lose their color at distances, it was stated.

For most purposes, offices, schools, factories, flashlights, etc., blue was not approved for blackout purposes.

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OPM Power Branch Moves

For the first time since organization of OPM the Power Branch staff under J. A. Krug now has office space together. From a half-dozen separated office suites, the staff has moved to the new temporary building R across the street from the Social Security building headquarters of OPM. The Power Branch staff occupies the entire third wing of temporary R.

First P–46 Report Forms Set Up "Par" for Future

OPM will estimate 1942 requirements of each utility from reported data on five major materials and supplies groups — Important to exclude certain stocks

First report forms under Priorities Order P-46, designed to provide the basic data from which to determine the amount of scarce materials needed for utility repairs and maintenance, have been sent to all utilities. They are to be filled out and returned by the end of this month.

Identified as OPM Form PD-194A and FPC Form 217 for electric utilities, the questionnaire calls for detailed data on 1940 and 1941 withdrawals of materials from stores, and for both physical unit and dollar value of inventory as of Dec. 31, 1940.

"Par" for the Future

The data reported by individual utilities will become their "par" figures for future purchases, withdrawals and inventories of repair and maintenance materials under the Section F limitations of P-46. This section limits utility withdrawals and inventories to 1940 dollar levels.

The form sets up five specific "control points" to which the Section F limitations are applicable. They are: Total generating station materials and supplies (other than fuel); total switching and substation materials and supplies; total wire, cable and busbar; total transmission and distribution materials (excluding wire, cable, wood poles and crossarms, and meters); other materials and supplies.

In other words, the limitation features of P-46 not only cover total repair and maintenance purchases, withdrawals and inventories, but apply with equal force to each of these five subdivisions of the total.

Will Estimate 1942 Needs

In addition to establishing individual utility "pars" for administration of P-46, OPM expects from the data supplied to be able to estimate the volume of repair and maintenance materials electric utilities will require in 1942 under this order. It is from this estimate, and similar ones from other industries, that OPM will be guided in allocating scarce raw materials.

Utilities, in filling in each of the 30 specific items of data required, should include only those materials which were used for repair and maintenance operations, or for operating supplies, or which were in stock for these purposes.

Instruction "D" on the reverse of the form permits inclusion of maintenance materials, supplies and repair parts which were charged directly to operating expense or property accounts as part of 1940 or 1941 withdrawals, or as part of inventory. Effect of such inclusion will be to give utilities a somewhat larger "par" base than would be the case if withdrawals and inventory were tightly limited to actual stores accounts.

In none of the schedules, however, should utilities include in withdrawals or inventories materials and supplies on hand for major new construction or those obtained with priority assistance other than the A-10 granted by P-46 for other construction purposes.

The form is a joint undertaking of FPC and the Power Branch of OPM, and both agencies expect to make use of some of the data called for. FPC mailed the forms and utilities are to return them to that agency, which will tabulate over-all totals. Two copies are to be returned, one of which FPC will send to the Power Branch.

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Price Ceiling Set on Domestic Ranges

A price ceiling was established this week on all types of domestic cooking and heating stoves, first formal price schedule applicable to consumers' durable goods. The ceiling is applied to manufacturers' prices, but the Price Administration publicly warned that it would watch for unwarranted markups in charges by wholesalers and retailers.

Top prices permitted for "regular line" stoves under Schedule 64 is 112 percent of the lowest quoted price during the period January 15 to June 1, 1941. "Private brand" unit prices cannot exceed 112 percent of the lowest price charged in the same base period.

In addition, the OPA schedule requires that manufacturers obtain advance approval of prices to be charged for all new models or models upon which specifications are altered beyond certain specified limits set forth in the schedule, in an avowed effort to prevent circumvention of price ceilings by reduction in quality.

Philadelphia Record

PHILADELPHIA ELECTRIC CHRISTMAS—The women's committee of the Philadelphia Electric Co. again this year entertained some 600 children from city institutions. Each child was given a toy and box of candy after enjoying a show

Westinghouse Output Recently Doubled

The electrical industry's number one job in 1941 has been production of electrical equipment essential to every branch of war effort. The industry is doing this job well. It produced more equipment in 1941 than ever before. It will better this record in 1942, George H. Bucher, president Westinghouse Electric & Manufacturing Co., said in a year-end statement.

"At Westinghouse we have doubled our output since the start of the emergency," he said. "Our factories are building propulsion equipment for the Navy, power and lighting equipment for the Army, Navy and Air Corps and for other defense industries.

"Our research engineers have developed a new plastic which may be used to replace aluminum as the nose on anti-tank and anti-aircraft shells. To help arsenals study behavior of bullets in gun barrels, research men at our lamp division laboratories have developed an X-ray machine to take pictures through an inch thickness of steel in a millionth of a second. X-ray machines are also helping industry to study the interior of steel parts. Many other devices developed by the Westinghouse research laboratories cannot now be made public, but are doing their part toward the winning of the war.

"During the year we completed three 108,000-kva. waterwheel generators for Grand Coulee Dam and started work on three more of these power-making machines, which are the largest waterwheel-driven units in the world. Westinghouse also completed a 40,000-hp. motor which has been installed in the new wind tunnel at the U. S. Army Corp's Wright Field. It will drive air through the tunnel at 400 miles an hour to test new fighting plane models. Knowledge thus gained will be helpful in designing better transport planes as well as military planes."

Westinghouse equipment has helped to insure a steadily growing supply of aluminum and magnesium, Mr. Bucher said, by tripling production of the ignitron, which changes a.c. into d.c. required to produce aluminum from purified bauxite and to recover magnesium from sea water.

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Boston Engineers Move

Howard M. Turner and Samuel M. Ellsworth, consulting engineers, formerly located at 12 Pearl Street, Boston, Mass., have removed their associated offices to 6 Beacon Street, Boston. Mr. Turner was identified with the Turners Falls Power & Electric Co., in connection with its hydro-electric construction developments in the Connecticut Valley before going to Boston to engage in private practice, and Mr. Ellsworth specializes in sanitary engineering. Both are lecturers at the Harvard Graduate School of Engineering, Cambridge, Mass.

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Manly Vice-Chairman of Power Commission

The Federal Power Commission this week elevated Basil Manly to its vice-chairmanship, succeeding Claude L. Draper, who has held the post for the last two years.

Manly, in 1938, was vice-chairman of the National Defense Power Committee headed by the then Undersecretary of War Louis Johnson. This committee prepared a confidential report outlining power policies and requirements for a war period.

A member of the commission since 1933, Manly previously was vice-chairman from 1933 to 1936. He is author of "Defense Power Requirements," a paper published in 1938 as a result of his work with the Johnson committee.

MEETINGS

Missouri Valley Electric Association—Power sales conference, Continental Hotel, Kansas City, Mo., January 15-16; annual engineering conference, Hotel Continental, Kansas City, Mo., March 26-27. L. D. Pettegrew, director 1527 Sharp Building, Lincoln, Neb.

Canadian Electrical Association — Annual winter conference, Mount Royal Hotel, Montreal, Que., January 19-20; Western members, joint meeting with Northwest Electric Light & Power Assn., Business Development Section and Commercial Section, Vancouver, B. C., March 4-6. B. C. Fairchild, secretary, 804 Tramways Buildings, Montreal.

American Institute of Electrical Engineers—Winter convention, New York, N. Y., January 26-30. H. H. Henline, national secretary, 29 West 39th St., New York, N. Y.

American Society of Heating and Ventilating Engineers—Annual meeting, Philadelphia, Pa., January 26-28. A. V. Hutchinson, secretary, 51 Madison Av., New York.

Edison Electric Institute — Electrical equipment committee, William Penn Hotel, Pittsburgh, Pa., February 2-3; transmission and distribution committee, Hotel Cleveland, Cleveland, Ohio, February 9-11. Major H. S. Bennion, managing director, 420 Lexington Avenue, New York, N. Y.

American Institute of Mining and Metallurgical Engineers—Annual meeting, Institute headquarters, New York, February 9-12. A. H. Parsons, secretary, 29 West 39th Street, New York, N. Y.

National Electrical Manufacturers Association — Midwinter meeting, Palmer House, Chicago, Ill., February 16-20. W. J. Donald, managing director, 155 East 44th Street, New York, N. Y.

American Society for Testing Materials—Committee week and spring meeting, Hotel Cleveland, Cleveland, Ohio, March 2-6; annual meeting, Chalfonte-Haddon Hall, Atlantic City, N. J., June 22-26. R. E. Hess, assistant secretary, 260 S. Broad St., Philadelphia, Pa.

Oklahoma Utilities Association—Annual convention, Biltmore Hotel, Oklahoma City, Okla., March 23-24. Miss Kate A. Niblack, secretary, 625-626 Biltmore Hotel, Oklahoma City, Okla.

American Society of Mechanical Engineers — Spring meeting, Rice Hotel, Houston, Texas, March 23-25. C. E. Davies, national secretary, 29 West 39th St., New York, N. Y.

Street Lights Cut as Strike Impends

While a mediation board appointed by Gov. Murray Van Wagoner of Michigan began conferences in an effort to avert a strike at the Hillsdale, Mich., municipal power and water plants, and while Hillsdale factories engaged in defense works are fearing a shortage of generating capacity for their needs at the municipal plant, the local Board of Public Affairs decided that, beginning January 5, one-half of the city street lights would be turned off as a means of conserving power for defense industries. The saving will be afforded by turning off every other boulevard light.

The Board of Public Works has decided to send a representative to Washington to ask the Federal Power Commission to authorize a stand-by power hookup with the Consumers Power Co.

Meanwhile, the power and water plant workers, members of the American Federation of State, County and Municipal Employees' Union, have rejected a compromise of wage increases and have demanded a contract and recognition of their union.

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Drop Condemnation Suit for Duration

Expressing a significant attitude on acquisition of private utilities during war-time, the city of Bremerton and Kitsap County Public Utility District have confirmed that condemnation proceedings against Puget Sound Power & Light Co. properties will be held in abeyance for the duration of the war.

Officials were understood to have conferred with representatives of federal power agencies in the matter of cooperating to assure sufficient supply of energy for vital defense production in the Northwest.

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Exposition Postponed

Announcement has been made that the emergency created by the sudden turn of events in the world has made it advisable to postpone the seventh International Heating and Ventilating Exposition which was scheduled to be held in Philadelphia January 26–30. Conditions facing the heating, ventilating and air conditioning industry, the limitations necessarily placed on production for civil use, and the all-out effort to war-conditon the nation have caused a number of manufacturers to feel that exhibiting at this time would detract from the war effort.

Output Starts Year With Small Gain

The amount of electrical energy distributed by the electric light and power industry for the week ended Saturday, January 3, was 3,286,705,000 kw.-hr., according to the Edison Electric Institute.

This figure is subject to revision as reports had not been received at press time from certain companies.

Nevertheless, attention is directed to the gain of 52,577,000 kw.-hr. in the New Year week because it is so much smaller than the 88,468,000 kw.-hr. gain in the corresponding week a year ago and the 93,385,000 kw.-hr. gain recorded two years ago.

Percentage-wise, the gain is more marked inasmuch as output during the final weeks of 1940 and 1939 was lower than that in the final week of 1940.

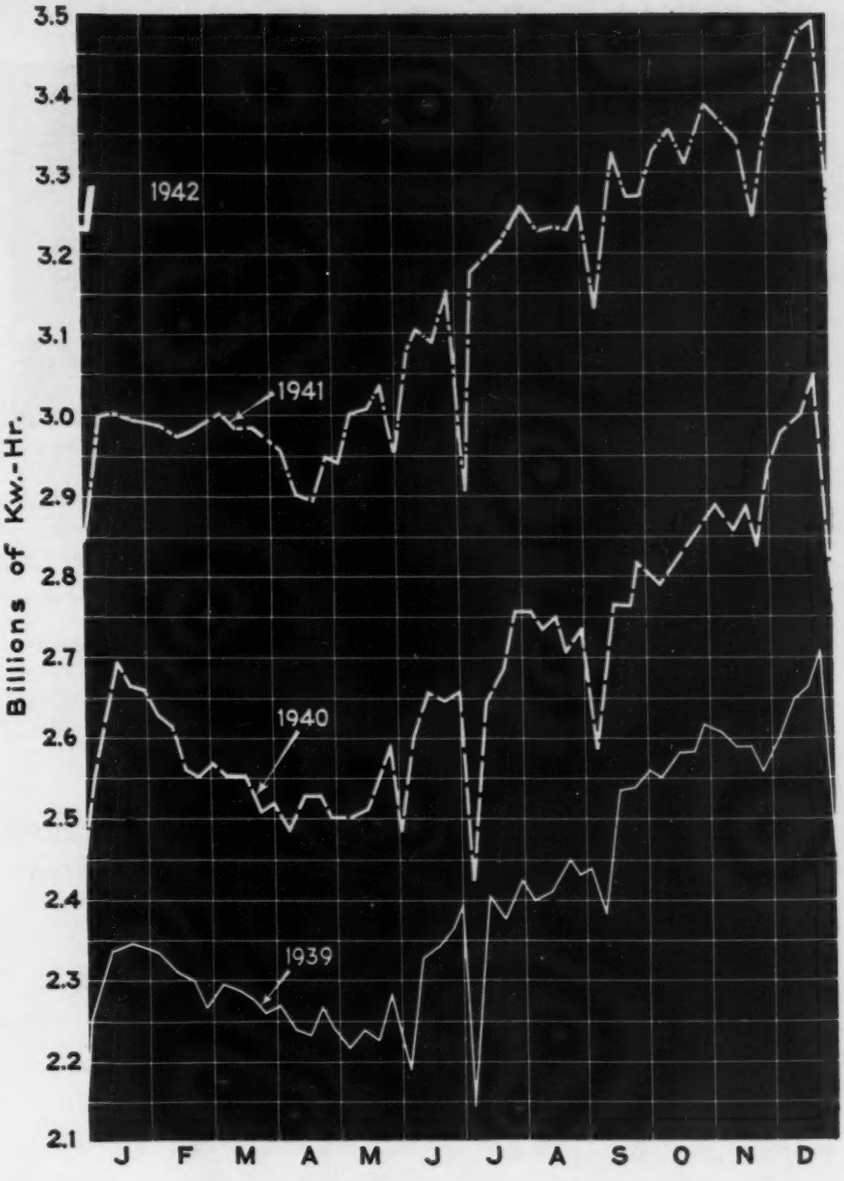
Weekly Output, Millions Kw.-Hr.

1942		1941		1940	
Jan. 3	3,287*	Jan. 4	2,846	Jan. 6	2,558
1941		1940		1939	
Dec. 27	3,234	Dec. 28	2,757	Dec. 30	2,464
Dec. 20	3,495	Dec. 21	3,052	Dec. 23	2,712
Dec. 13	3,476	Dec. 14	3,003	Dec. 16	2,674
Dec. 6	3,415	Dec. 7	2,976	Dec. 9	2,654
Nov. 29	3,293	Nov. 30	2,932	Dec. 2	2,605

Percent Change from Previous Year

	Week Ending		
	Jan. 3	Dec. 27	Dec. 20
New England	+16.9	+16.5	+17.1
Mid-Atlantic	+11.4	+13.2	+10.7
Central Industrial	+13.9	+15.1	+13.4
West Central	+15.7	+15.6	+12.8
Southern States	+17.2	+19.4	+16.4
Rocky Mountain	+16.5	+22.1	+12.9
Pacific Coast	+23.6	*+11.9	*+ 7.9
Total United States	+15.5*	+15.6	+13.0

* Subject to revision.



FPC Reports Power Production Rise

Electric energy produced for public use in November, 1941, totaled 14,230,305,000 kw.-hr., an increase of 13.7 percent over production in November, 1940, according to a report issued by the Federal Power Commission.

Average daily production of electric energy for public use during the month reached an all-time high of 521,256,000 kw.-hr., an increase of 1.2 percent over average daily production during the previous month. Production by water power in November amounted to 4,066,402,000 kw.-hr., or 28.6 percent of the total output for public use.

For the twelve months ended November 30 total production was 162,763,000,000 kw.-hr., an increase of 15.5 percent over the 140,953,000,000 kw.-hr. produced in the twelve months ended November 30.

The capacity of generating plants in service in the United States on November 30 totaled 43,788,037 kw., a net increase of 375,331 kw. over generating capacity reported in service on October 31.

•

Dallas Asked to Approve Utility's Expansion

Approval of Dallas Power & Light Co.'s application for permission to spend $140,500 for transformers, meters and lines needed to extend service to new customers during the first half of 1942 has been recommended by Frank R. Schneider, supervisor of public utilities. The supervisor's recommendation will go to the City Council. Expenditures will include $81,000 for transformers and $89,500 for meters, extensions and service lines.

The utility has recently placed an order with the General Electric Co. for a generator for a $2,260,000 addition to its Mountain Creek power plant.

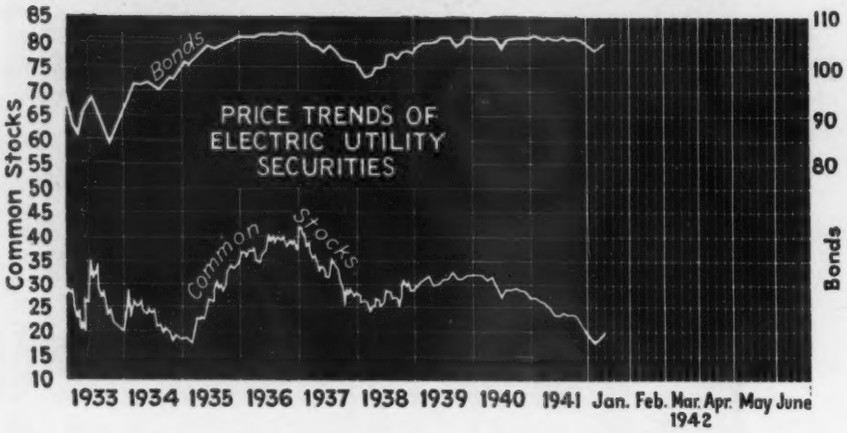
•

Daylight Saving Looms

Legislative leaders agreed at White House conferences with the President this week to expedite passage of legislation permitting presidential invocation of daylight saving time in all or part of the country for all or any part of the year.

The pending bills before both chambers are expected to be amended to permit directives setting clocks either one or two hours ahead. Bills were sponsored originally last summer at the request of the President, acting upon a recommendation of the Federal Power Commission, but no action was ever taken.

Stock and Bond Prices Turn Upward


PRICE TRENDS OF ELECTRIC UTILITY SECURITIES
Bonds
Common Stocks
Common Stocks
85 80 75 70 65 60 55 50 45 40 35 30 25 20 15 10
110 100 90 80
Bonds
1933 1934 1935 1936 1937 1938 1939 1940 1941 Jan. Feb. Mar. Apr. May June 1942

In line with the general market trend, utility securities prices rallied during the past week. "Electrical World" stock index advanced to 20.1 from 17.9 the previous week; last year, 27.3. Bonds went to 105 from 104.5 the previous week; last year, 106.1.

Sale of Louisville Stock Moves Slowly

First official data on the progress of the public sale of 150,000 shares of Louisville Gas & Electric common appears in an SEC release, revealing that 21,765 shares had been sold up to December 9.

The commission has given the company until March 23 to dispose of the unsold 128,235 shares.

Originally the company was given until December 21 to sell the issue, through company employees, at $23.50 per share. As a concession to local financial firms the company agreed to pay them 75 cents per share sold by employees.

•

Co-op Loses Tax Appeal

Ohio Supreme Court has ruled that properties of rural electric co-operatives may be assessed for taxation on the same basis as other privately owned electric utilities, in the appeal of the South Central Rural Electric Co-operative, a non-profit corporation, from the state tax department's valuation of $326,100.

•

Rejects Plant Bids

With two contracts already awarded by the Board of Control of Reading, Ohio, all bids for the general contract to construct an addition to the municipal electric plant were rejected and will be readvertised. The contracts let included piping and auxiliary equipment. Construction bids ran higher than was expected by the board, and it is probable that additional bonds will have to be issued to raise the necessary funds. The entire plan embraces an enlargement of the electric plant to increase its capacity 2,500 kw. Its present capacity is 1,900 kw. The cost will be in excess of $300,000.

•

Compromise Reached on TVA Power

Tennessee Valley Authority and the Legislative Council have agreed on legislation to exempt from jurisdiction of the state Public Service Commission Kentucky cities which want to buy TVA power for resale through city-owned distribution systems.

On the other hand, it was agreed to maintain jurisdiction of the commission over cities which want to generate their own power or buy it from a source other than TVA.

The compromise was offered by Lieut.-Gov. Rodes K. Myers after William C. Fitts, Jr., TVA general counsel, and John Kirtley, chairman of the Public Service Commission and a member of the council, were deadlocked in their points of view.

•

Engineers Study Carolina Rivers as Power Sites

U. S. Engineer Office at Charleston, S. C., has investigated potential hydro-electric sites on the principal streams draining into the Atlantic Ocean on the coast of South Carolina northeast of Port Royal Sound. These comprise two large river systems, the Yadkin-Peedee and the Santee.

Comprehensive reports dealing with flood control, power development and navigation have been submitted on each of these river systems and these reports are now being reviewed in accordance with resolutions of the commerce committee of the United States Senate to determine the advisability of improving conditions for navigation on the Santee and Congaree rivers to Columbia, on the Wateree River to Camden, and on the Peedee River to Cheraw and for the development of hydro-electric power.

•

Government Loses Big Bend Decision

In a recent decision on the federal government's objections to the Big Bend Transit Co.'s claims of power site value for its narrows lands on the Spokane River, Federal Judge Lewis B. Schwellenbach held the company had power site rights on its narrows lands. Upholding the defense in every particular, the decision ended the first phase of the government's condemnation suit against the company for property inundated by the backwaters of Grand Coulee Dam.

It was the contention of the government that the company had no legal rights to the north shore lands nor to the water's flow or power site value of any lands, and the government placed a value of $32,073 on lands on the south bank of the river. This value was given it only as agricultural land. Judge Schwellenbach ruled the company had acquired rights to the power site from the Secretary of the Interior under the act of Congress of March 3, 1905, and that the power act of 1920 had not voided those rights. The company's expenditures, paid "in reliance upon government interpretations of its rights," cannot be set aside without compensation under the Fifth Amendment to the Constitution, Judge Schwellenbach ruled.

While it is expected the case will be appealed by U. S. District Attorney Keith, the condemnation award suit to set the value the government must pay for the flooded lands will first be submitted to a jury in Spokane, probably in February.

Utility Reports

	Net Income 1941	1940
*Birmingham Electric	$879,058	$486,477
*Carolina Power & Light	3,040,062	3,834,946
*Central Arizona Lt. & Pwr.	604,798	900,849
*Commonwealth & Southern and subs.	12,078,102	13,235,075
*Cons. Gas Elec. Lt. & Pwr. (Baltimore)	5,877,713	5,708,528
*Dallas Power & Light	1,973,804	1,942,913
*Florida Power & Light	2,584,019	2,334,199
*Kansas City Pwr. & Lt.	3,690,404	3,749,400
*Superior Water, Lt. & Pwr.	91,823	110,318
*Texas Electric Service	1,186,134	1,326,086
*Texas Power & Light	1,735,710	1,942,708
*Washington Water Power and subs.	1,860,586	2,871,643

* Twelve months ended November 30.

HOW DESIGN . . . CONSTRUCT OPERATE MAINTAIN

Underground Lines

Duct Splicing Simplified

By W. B. ELMER
Boston Edison Company

That duct splicing may be done without special cable-handling facilities is shown in the accompanying illustrations, contrasting the method originally used by companies pioneering in this work, and modified to eliminate lifting a reel, with a simple but effective scheme employed by Boston Edison. In the last-named case, with the reels placed as shown below and a pair of wooden lags supporting the splice, the work is carried to a point where lead burning on the under side of the sleeve would be necessary.

With the splice tied to the lags the reels are rolled, or are jacked up and turned to bring the splice to the opposite side in order to complete the lead burning.

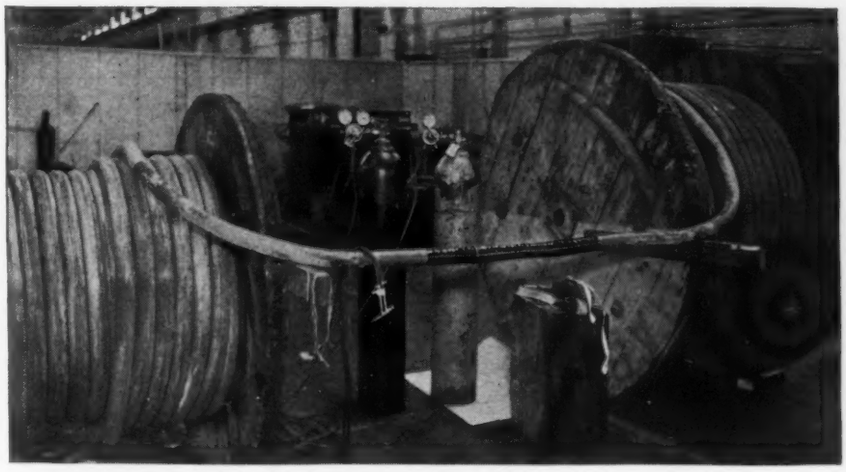


FIG. 2—Position of duct splice in using method Fig. 1(c)

Industrial Heat

Load Characteristics of Small Arc Welders

By L. W. WYSS*
Wisconsin-Michigan Power Company,
Iron-Mountain, Mich.

If an arc welder is to be added to a utility distribution system it is necessary to know (1) length of the secondary line, (2) size of wire, (3) transformer size, (4) transformer resistance, and (5) transformer reactance besides welder rating data in order to determine the exact drop in voltage that will result. However, the accompanying approximate tables can be used to find out the average voltage dips caused by welders of five classifications which are commonly found in small workshops.

Table I lists five classifications with their approximate cost to the user, along with their welding, amperes, voltage, line amperes and kilowatts.

Table II shows the volts lost in the average distribution transformer

*Abstract of a paper presented before Wisconsin Utilities Association Electric Section convention, Milwaukee, October 13-14, 1941.

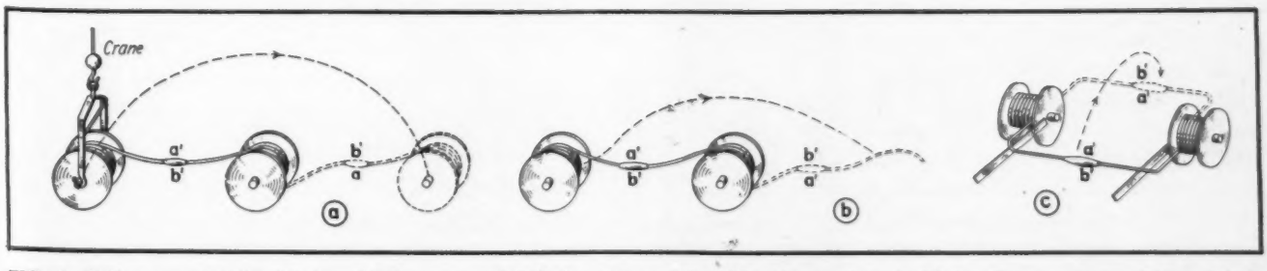

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Table I—Typical Workshop Welders

Welding Amps.	Cost	Volts	Line Amps.	Kw.
75	$20.00	115	32	2.4
75	30.00	230	16	2.4
140	75.00	230	25	3.7
200	100.00	230	48.5	6.2
300	150.00	230	65	8.2

Table II—Transformer Voltage Loss Table for Typical Arc Welders

Welding Amps.	Size of Transformer in Kva. 1½	3	5	7½	10	15
75 (115 v.)	10	4	3	2	1	..
75 (230 v.)	20	8	5	3	2	..
140 (230 v.)	34	13	8	5	4	2.5
200 (230 v.)	..	23	14	9	7	5
300 (230 v.)	..	32	19	13	10	6

Table III—Volts Lost in Secondary Lines With Typical Welders

Welding Amps.	No. 6 Copper 250 Ft.	500 Ft.	750 Ft.	1,000 Ft.
75 (115 v.)	6	13	19	26
75 (230 v.)	3	7	9	13
140 (230 v.)	5	10	15	20
200 (230 v.)	10	19	29	40
300 (230 v.)	13	26	..	..

Welding Amps.	No. 4 Copper 250 Ft.	500 Ft.	750 Ft.	1,000 Ft.
75 (115 v.)	4	8	12	16
75 (230 v.)	2	4	6	8
140 (230 v.)	3	6	9	12
200 (230 v.)	6	12	18	24
300 (230 v.)	8	16	24	33

Welding Amps.	No. 2 Copper 250 Ft.	500 Ft.	750 Ft.	1,000 Ft.
75 (115 v.)	2.5	5	7.5	10
75 (230 v.)	1.5	2.5	4	5
140 (230 v.)	2	4	6	8
200 (230 v.)	4	8	12	16
300 (230 v.)	5	10	15	20

when connecting any of five average arc welders.

Table III shows the volts lost for the same welders with different sizes of wire at various distances.

From the three tables a rough idea can be obtained of the effect of an electric welder on the distribution system. For example: If a 160-amp. welder were to be installed on a No. 4 secondary line, 750 ft. from a 5-kva. transformer, Table II would show that the volts drop in the transformer would be eight, and Table III would reveal nine volts drop in the secondary line, or a total drop of 17 volts, caused by the arc welder alone.

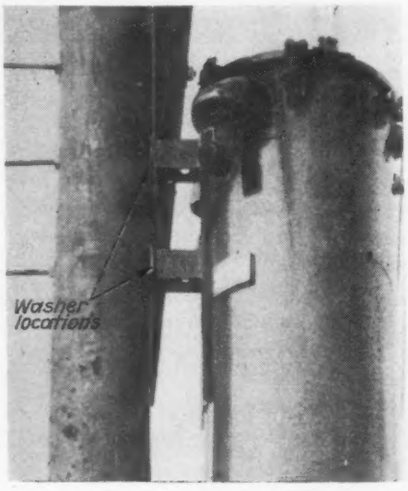
The largest workshop welder does not offer any very serious voltage problem with transformers of 15 kva. and up, or when the welder is close to a transformer with No. 2 copper in use, as the tables reveal.

Where a separate transformer is provided for the welder, economy would dictate the use of a unit which would have a kva. capacity of about one-half the kva. rating of the welder. This allows about fourteen volts drop, which should not prove objectionable.

Pole Lines

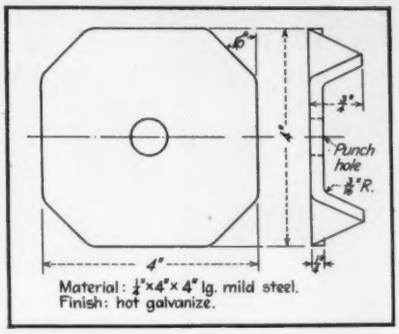
Washer Designed for Transformer Mounts

In mounting pole type transformers according to the recommendations of E.E.I.-N.E.M.A., it is customary to use a 4-in. square washer between the transformer brackets and the pole.



TRANSFORMER mounted on pole for shock test: washers provide seat for brackets without requiring gains

On the Connecticut Power Company's system this detail has been modified by the special (Line Material Company) washer illustrated, in order to do away with additional gaining on poles not carrying transformers. The E.E.I.-N.E.M.A. method assumes that poles will be gained to receive washers, but this involves extra expense either through ordering poles with this additional gain from the supplier or from cutting gains in the field. The special washer illustrated has been adopted by Connecticut Power as a



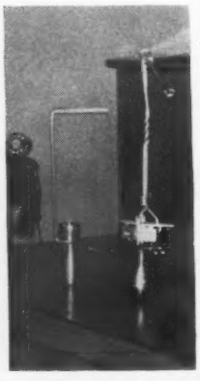
DETAILS of washer designed to avoid pole gaining

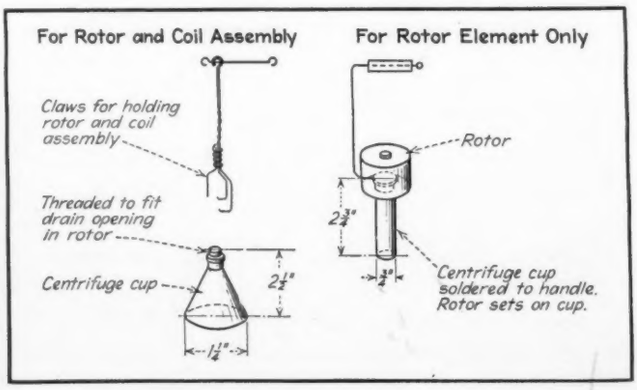
standard, and as shown was used in a transformer mounting in connection with recent testing for mechanical shock.

Meters

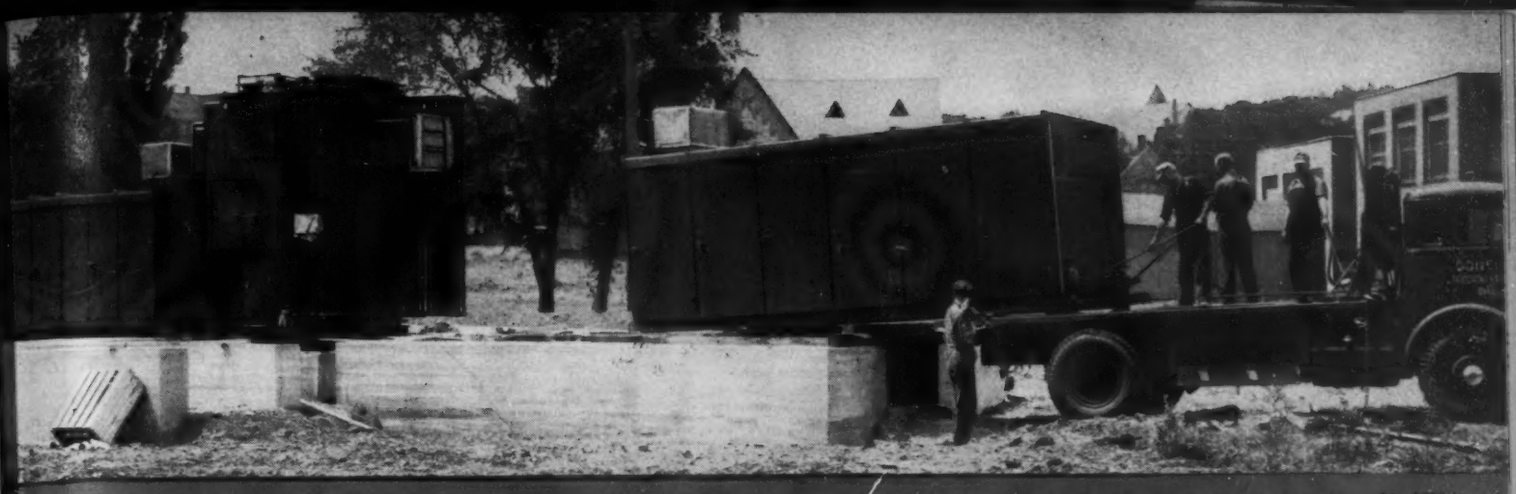
Sling Centrifuge for Clock Rotors

Ingenious sling centrifuges are used in the meter department of the Nebraska Power Company to expel oil and cleaning solution from the Telechron clock rotors speedily. Two "slings" are in use. One will handle the Telechron motor and rotor assembly used on "M-20" and "21" demand dials, avoiding dismantling; the other will centrifuge any rotor element only. Use of the device has greatly speeded the maintenance of these clocks. Formerly, oil, cleaning solution and rinse oil were drained by inverting the part in a tray. Centrifuging has cut time to drain to a few minutes. To use, the rotor is clamped in the wire sling, the oil drainage plug removed and a centrifuge cup substituted. The "sling" and rotor are then swung by hand for a minute or two until all fluid is expelled.



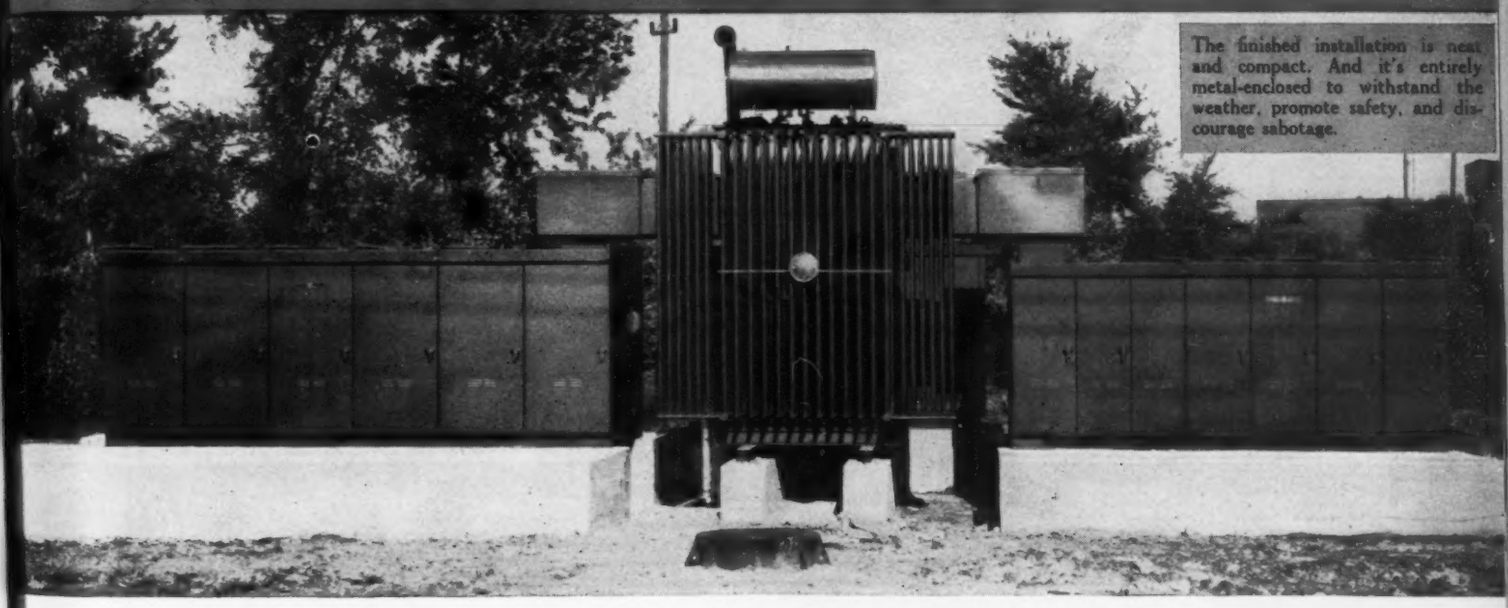


HAND CENTRIFUGES for expelling cleaning solutions



Even large unit substations (such as this 3000-kva unit for the Board of Public Utilities of Jamestown, N. Y.) are easily and quickly installed—and at lower over-all cost than that of old style, piecemeal substations. The completely assembled sections (properly co-ordinated) need merely be skidded into position and bolted together. Then make the necessary connections and your unit substation is ready for service.

How to Supply Today's Loads *with AN EYE ON TOMORROW*



The finished installation is neat and compact. And it's entirely metal-enclosed to withstand the weather, promote safety, and discourage sabotage.

EXPAND with UNIT SUBSTATIONS

THEY not only save you installation time, space, and reduce construction requirements; they also provide *flexibility* to meet future changes in load conditions.

A G-E unit substation is delivered in completely factory-assembled, ready-to-install sections; installation is a matter of days rather than weeks. It's compact and designed for outdoor service, making a large investment in real estate and buildings unnecessary. And you can locate it *close to the load center,* so feeders are shorter, losses lower, service better.

Then when load conditions change, it's a comparatively simple matter to move your unit substation to a new load center. In short, here's the practical, farsighted answer to the changing power requirements of *today and tomorrow.* Catalog GEA-2996 or your local G-E representative will give you more information—call or write today. *General Electric Company, Schenectady, N. Y.*

GENERAL ELECTRIC

401-7-170C

OIL-FILTERING APPARATUS fits compactly into 9 x 6 x 6½-ft. special truck body

Build Filter Plant Into 1½-Ton Truck

By P. W. MEINHARDT
Union Electric Co. of Missouri
St. Louis, Mo.

Duty required of apparatus for filtering insulating oil in the transformers and oil circuit breakers of moderate-sized substations scattered over a large system such as the Union Electric Company of Missouri calls for some form of self-contained mobile equipment that can be transported readily and set up to perform any filtering job likely to be encountered. Arrangement of such a portable filtering unit of 30 g.p.m. capacity recently placed in operation on the system of this Missouri utility is shown herewith.

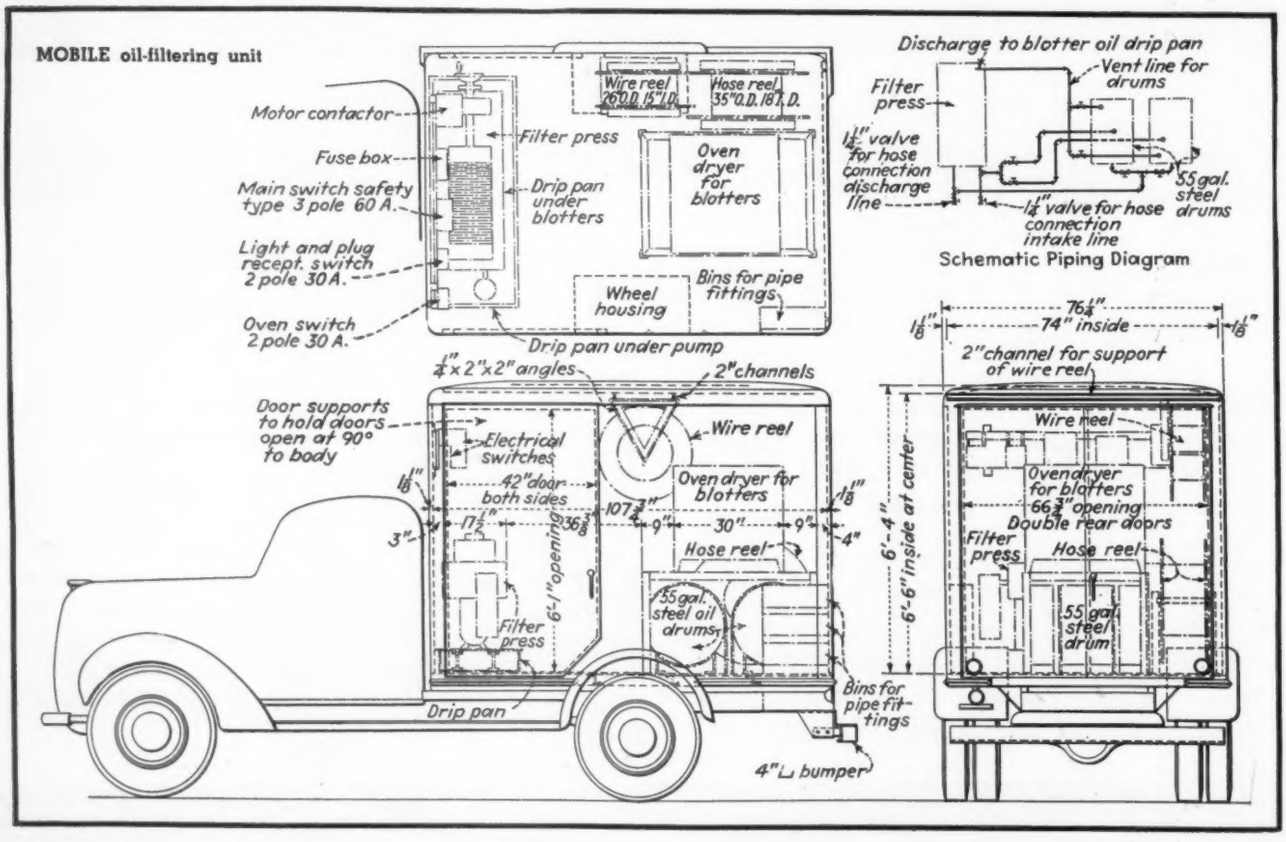
The new unit displaced a filter of very limited capacity, which was mounted in a wooden body on an old army trailer. Capacity of the filter was too small for the large capacity transformers that were being installed and the trailer, in addition to being cumbersome, tied up truck equipment needed elsewhere.

When a new apparatus was being considered, cost analysis showed that a 30-gal. filter on a 1½-ton truck with a custom-built body was less expensive than a specially built steel trailer for the apparatus. The truck mounting was, therefore, adopted.

In arranging the equipment within the trailer body (which is 9 ft. long, 6 ft. 2 in. wide and 6 ft. 6 in. high inside) the filter, which is the heaviest equipment, was located in front and auxiliary equipment arranged around it. Doors were provided in the body on each side of the filter to provide easy access. "Start" and "Stop" buttons "pick-up" a motor contactor to operate the filter press motor. For convenience, it was installed near the floor of the truck to enable the operator to control the motor from the ground.

The oven for drying filter press blotters was mounted in the rear of the truck.

Reel for the 150 ft. of three-conductor No. 8 cable supplying the truck is suspended from the truck roof on the same side and above a


MOBILE oil-filtering unit
Motor contactor
Fuse box
Main switch safety type 3 pole 60 A.
Light and plug recept. switch 2 pole 30 A.
Oven switch 2 pole 30 A.
Wire reel 26" O.D. 15" I.D.
Hose reel 35" O.D. 18" I.D.
Filter press
Drip pan under blotters
Oven dryer for blotters
Wheel housing
Bins for pipe fittings
Drip pan under pump
Door supports to hold doors open at 90° to body
Electrical switches
42" door both sides
Wire reel
Oven dryer for blotters
Hose reel
55 gal. steel oil drums
Filter press
Drip pan
4" ⌴ bumper
Discharge to blotter oil drip pan
Vent line for drums
Filter press
1½" valve for hose connection discharge line
55 gal. steel drums
1¼" valve for hose connection intake line
Schematic Piping Diagram
74" inside
2" channel for support of wire reel
Wire reel
Oven dryer for blotters
66¾" opening
Double rear doors
Filter press
Hose reel
55 gal. steel drum
6'-6" inside at center
Bins for pipe fittings

LOOK!

A REAL TIME SAVER FOR LOAD AND VOLTAGE SURVEYS

An Instrument That Gives You a Month's Operation on a 30-inch Chart

Type CF-1 low-chart-speed recorder
(both ammeters and voltmeters are available)

WHEN analyzing load or voltage surveys, it is no longer necessary to reel off 60 ft of strip chart, or to examine a number of round charts. This new instrument gives you a 30-day operating record on a 30-in. chart—thus you can quickly check current or voltage conditions for an entire month, or for any 24-hr period.

A 4-day record can be seen through the glass window. This makes it possible to check the record without opening the instrument and unrolling the chart.

IT'S INKLESS—REQUIRES NO ATTENTION

This new instrument is an addition to our proved Type CF line of inkless recorders. It is the inkless feature that makes possible the one-inch-per-day chart speed. At such a low speed, an ink recorder would form pools of ink that would blot out the record.

The inkless feature also enables the instrument to operate for a month without any attention, because the old troubles of pen clogging and ink freezing or evaporating are eliminated. Accurate in extremes of temperature—from −10 F to 120 F.

This instrument will be a worth-while addition to your testing equipment and should soon pay for itself in the time it saves. Bulletin GEA-3187 gives complete information. General Electric Company, Schenectady, N. Y.

HEADQUARTERS for ELECTRICAL MEASUREMENT

GENERAL ELECTRIC

hose reel that holds 150 ft. of 1¼-in. Pyranite rubber hose. Both the cable reel and hose reel are made from No. 13 gage sheet iron. The cable reel is arranged so that as much or as little cable can be pulled from it as is needed to reach the outside service connection. To make this possible an electric range plug was installed in the cable reel. One end of the cable is connected to the female plug in the reel and the male part is attached to a cable leading to the three-pole truck main supply switch. While cable is being pulled from the reel the plug is disengaged, and when sufficient cable is out the plug is again inserted in the reel.

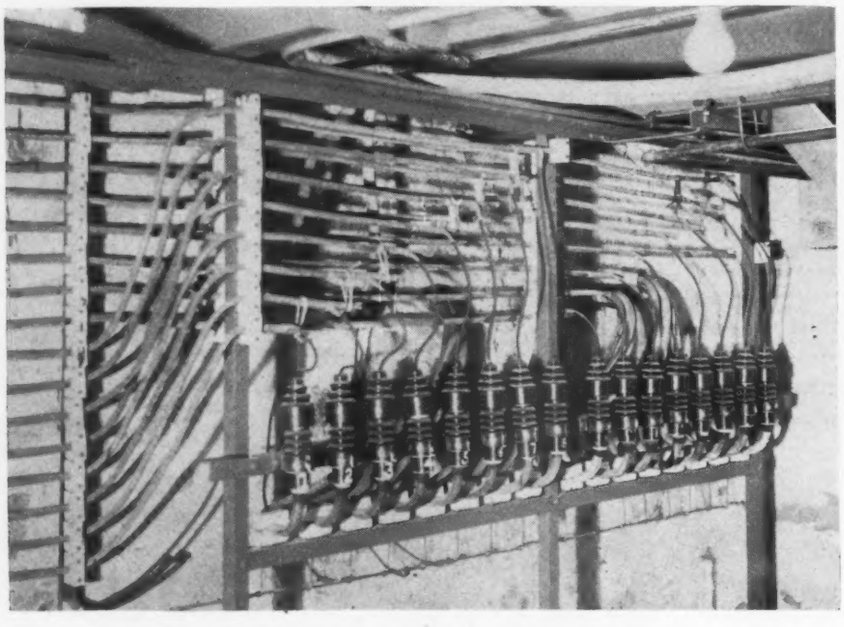
Minor accessories of the truck include two 55-gal. oil drums for reserve oil supply, a fire extinguisher on one of the truck's two rear doors, two 3-gal. buckets, a 2-gal. gasoline can, lights on the truck roof and bins for pipe fittings and plug receptacles.

Piping, a diagram of which is shown, is run from the storage oil drums under the floor of the truck to the filter.

Underground Lines

Open Rack Aids Cable Inspection

Street-lighting cables serving Norwood, Mass., are effectively racked in the lighting department substation on a simple framework of 2x2x¼-in. angle-irons accommodating sixteen cables in a space but 9 ft. long. The cables are connected to the outgoing runs through G & W disconnecting type potheads mounted in a single row and caring for eight circuits. All cables are grounded to a No. 4 copper wire at the bottom of the frame.



EIGHT street-lighting circuits accommodated in rack space 9 ft. long x 6 ft. high

Protection

Low Oil Level Causes Fuse Outages

By H. R. WEST
Division Distribution Superintendent
Idaho Power Company, Pocatello

Recently, after two severe lightning storms occurring on our Rockford 11-kv. feeder out of Blackfoot, a number of 6.9 kv. rating transformers were checked at locations where fuses were blown. This feeder is equipped with Matthews "Tee-gaps" for lightning drainage. The transformers were removed to the ground and in practically all cases it was found that the lightning had caused a flash-over with power follow-through either from the primary terminal block or the primary lead wires (with bad insulation) to the grounded case or cover of the transformer. All flashovers from the primary terminal block, usually only a 1-in. to a 1½-in. gap, were due to low oil. This was particularly true of the older type transformers, as the oil level only needs to recede an inch or two from the full mark on the case to leave the terminals of the block exposed. Correction was effected by bringing the oil level up to the proper height.

Flashes from defective insulation of the primary lead wires, usually to the cover of the transformer, can be corrected in most instances by bending the lead wire to give better clearance with the transformer lid. In cases where the lead wire cannot be bent to give sufficient clearance properly insulated leads should be installed.

In the case of old-style 2,200-volt transformers having a cast-iron case the primary terminal block is mounted so near the cover that in the smaller sizes at least it is impossible to submerge the terminal block in oil. If there is frequent fuse trouble in such instances it seems best to replace the transformer with one having better clearance conditions.

Local managers and service foremen should arrange to keep a record of transformer fuse outage locations so that frequent outage on the same transformers can be quickly spotted and a back check should be made to see if the failure point can be determined and corrected.

Industrial Power

Duplex Power Panels Insure Reliability

To keep down the cost of subfeeder protective equipment, improve the reliability of branch circuits fed from plant main power distribution panels and secure greater flexibility for expansion, the three large 220-volt power panels supplying machine-shop circuits at the McCulloch Engineering Company plant at Milwaukee are each divided into two sections, separately connected to the main 220-volt plant power feeder.

Distribution of 220-volt power within this new supercharger plant is basically radial. A 170-ft. run of 1,000-amp. Trumbull bus duct supplies the three duplex power panels that are mounted on the building columns. From these panels branches radiate to different machines.

Over-all voltage drop from the 300-kva., three-phase 26,400/220-volt power transformer serving the plant to the most remote machine is 4 percent. Smallest size wire in the plant

N PITTSFIELD WORKS ASSEMBLY LINE

WE SCRUTINIZE THE "LITTLE THINGS"

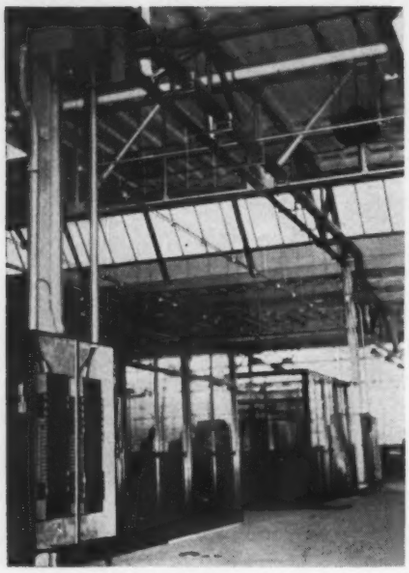
ONE reason why you get a full measure of value with G-E distribution transformers is our constant aim toward perfection of detail in both design and manufacture. Look into any operation in the building of a G-E transformer and you will find ample proof that this policy is definitely in force.

For example—the brazing of the terminals to the low-voltage leads during final assembly of the transformer interior. Because we use a silver-alloy insert in making the joint, we get a low-loss connection. Because the brazing process is *automatically* controlled, the quality of the brazing is uniformly high. Because *high-frequency* brazing is employed, we get permanence—a tough annealed joint instead of a brittle one.

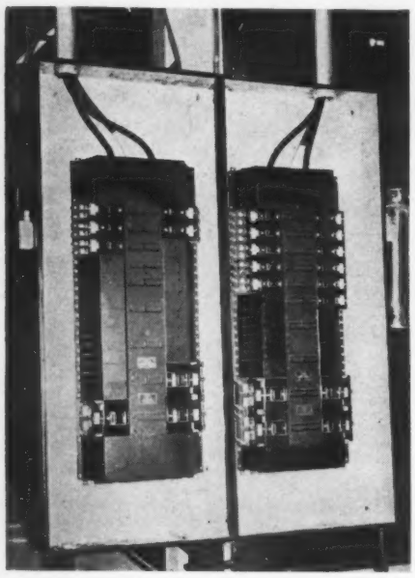
This constant attention to detail, verified by frequent inspections throughout manufacture, is a vital part in our program of providing better transformers at the lowest possible cost to the purchaser.

GENERAL ELECTRIC

660-21



MACHINE SHOP power panels divided into two sections fed separately from fused plug-in type switches on bus duct



CLOSEUP of duplex distribution centers with separately fed breaker type panels. Wiring was not complete when picture was taken

is No. 12. Each half of the duplex breaker type panelboards is supplied through individual 400-amp. fused Trumbull disconnect switches of the plug-in type attached to the bus run as shown in the illustration.

With this arrangement, if trouble develops between the main bus and the power panel, or in the panel itself, only half of the machines served by that load panel will be out of operation. Cost of the two fused plug-in switches was also considerably lower than that for a single switch of higher rating. Furthermore, as load within the plant grows, it is a simple matter to add another section to the power panels and a third plug switch to supply it from the main feeder.

Steam Plant

Novel Supply Scheme for Turbine Auxiliaries

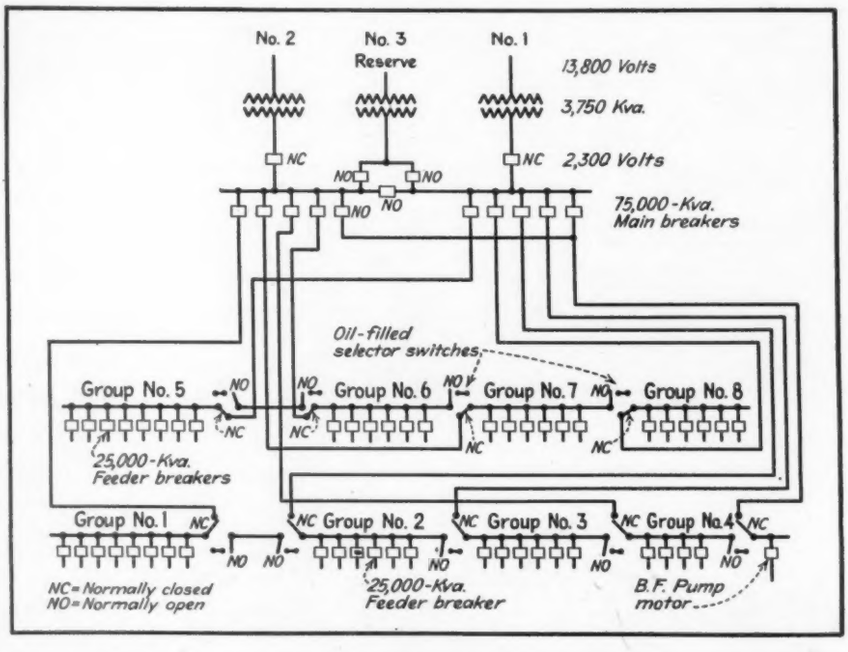
Branch circuit switching used in the auxiliary supply system for the 35,000-kw. turbo-generator added during 1939 at the Des Moines plant of the Iowa Power & Light Company is novel in that all circuit interruption is done by 75,000-kva. main bus section supply breakers rather than by individual feeder breakers. Isolation of the faulted feeder—once the supply breaker is open—is accomplished by 25,000-kva. feeder breakers. Immediate reclosure of main bus section supply breakers restores service to the unfaulted feeders of the affected bus section.

As shown in the accompanying diagram, there are eight bus sections in the 2,300-volt ring bus supplying auxiliary feeder circuits. Alternate sections are supplied from two main auxiliary buses connected to individual 3,750-kva., 13,800/2,300-volt transformers. A third transformer, used as standby, is automatically connected to either main bus through a tie bus and breaker arrangement upon emergency trip out of either of the two regularly operating transformers.

The eight sections of the ring bus are connected through oil-filled selector switches. These are normally open, allowing the sections to operate separately. In an emergency adjacent sections can be tied together and supplied from a single main feeder.

In the event of a fault on any bus section feeder circuit the breaker supplying the affected section drops out; in opening, it mechanically trips a d.c. pilot relay opening the faulted feeder breaker. As the feeder breaker opens it, in turn, operates a relay reclosing the section supply breaker, restoring service to the rest of the feeders on that section of bus. The entire operation takes places in about 35 cycles.

Economic aspects of this arrangement are noteworthy. With the 75,000-kva. interrupting capacity breakers (in service for station auxiliary equipment prior to this plant addition) used as the eight main section supply feeder breakers their higher interrupting capacity made it possible to use smaller 25,000-kva. breakers on the feeder circuits off the ring. The purchase of the lower kva. interrupting capacity breakers represented a considerable saving in capital investment.



FEEDER CIRCUIT faults interrupted by main bus supply breakers in novel auxiliary supply scheme

Like Adding Another Feeder-

But the Cost Is a Whole Lot Less

MANY UTILITIES REPORT LARGE GAINS IN NEEDED SYSTEM CAPACITY AFTER IMPROVING POWER-FACTOR WITH PYRANOL CAPACITORS

HOW RELIABILITY IS BUILT INTO PYRANOL CAPACITORS

Testing the resistance weld that joins the two halves of this Pyranol capacitor case. Pressure is applied from within through the hollow bushing stud. This is but one of a long series of checks made throughout the process of manufacturing G-E Pyranol capacitors—one more factor contributing to their outstanding dependability and long life.

ONE company obtained 500 kw of feeder capacity with Pyranol capacitors *at only $7.00 per kw.* Another company boosted substation "loadability" for only $15.84 per kva. Still another, after installing 1100 kva of Pyranol capacitors, reported a capacity increase *equal to another circuit.*

Pyranol capacitors might do a similar job on your system. By neutralizing reactive kva, they permit the existing feeders and substation equipment to carry more working current in order to meet the ever-increasing demands for more power.

Installing Pyranol capacitors is simple. Banks of any desired rating can be made up from standard 10- and 15-kva units; installation is merely a matter of hanging them on a pole and making connections. And when power demands change in the future, the capacitors can readily be shifted to new, more effective locations.

Why not investigate their remarkable possibilities? Call your G-E representative *now.* He'll be glad to tell you how Pyranol capacitors may provide the profitable solution of your overload problems. Ask for Catalog GEA-3333. General Electric, Schenectady, N. Y.

GENERAL ELECTRIC

407-14

Oscillograph Adapted for Retracing Improves Records

By R. W. AHLQUIST
Assistant Professor Electrical Engineering
Department, Iowa State College, Ames

Laboratory

Most oscillographs of the Duddell type which are on the market today are built to trace the path of a beam of light upon sensitive photographic paper or film. The trace of the beam of light is made only once, and hence requires an intense source of illumination (generally obtained by the overvoltage of an incandescent lamp) and also a shutter which opens and closes in the period of a revolution of the photographic drum.

Not Transients Only

A method of retracing is applicable to many oscillograph pictures where the phenomena are recurrent and it does not necessarily have to apply only to transients. All that is necessary is to trace over the pattern a sufficient number of times. Where the oscillograph is equipped with an oscillating or rotating mirror which sweeps the light across the stationary film no change is necessary in the oscillograph to retrace the pattern. Where the film or sensitive paper is inclosed in a rotating drum all that is necessary is to add a synchronous motor to drive this drum. The oscillograph pattern is controlled in intensity by adjusting the time of retracing rather than to adjust the intensity of the source of illumination. Measurement of the light beam is made on a ground glass. Then the glass is replaced by the film drum with its gear, which is meshed with the gear on the synchronous motor. The latter gear has an exact multiple of teeth of the film-drum gear.

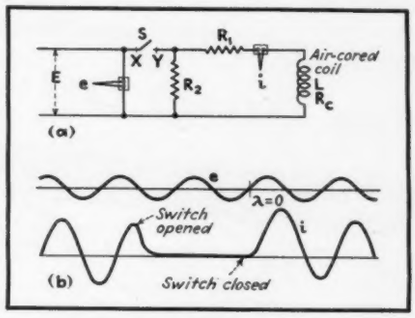
In one particular application the synchronous motor runs at 1,800 r.p.m. and the drum runs at 450 r.p.m. or 7.5 r.p.s. In one revolution of the drum a 60-cycle voltage acting upon the oscillograph element will cause its beam of light to give 8 cycles upon the sensitized paper. This will be retraced 7.5 times in one second. Thus one second of retracing will have the same effect as if the trace were made only once and the intensity of the source were increased 7.5 times. The synchronous motor which drives the drum can in most cases be run from the same a.c. line which supplies the phenomena being studied.

Flexible Operation

Bromide paper may be used in many cases, thus cutting down on photographic work. For this class of work the shutter may be opened and closed by hand. One voltage element may be used to trace all three phase voltages of a system by repeating the runs and switching the voltage element successively to each one in turn.

For classes of transient phenomena which can be repeated, the method of retracing has distinct advantages over single exposures. The transient visualizer is a synchronous switch which can be used to initiate the transient and then set the circuit in readiness for the next transient, which must be a duplicate of the first one.

A simple example of an oscillogram obtained of a current transient in a coil is shown in an accompanying illustration. In (a) the synchronous switch S represents a copper segment on an insulated cylinder. For the purpose of this illustration this segment may connect point X electrically to point Y for two-thirds of its period of revolution. For the balance of the period point X is disconnected from point Y. During the first period the current in the coil is reaching its steady state value. During the second



RETRACING TECHNIQUE—(a) Connection diagram showing oscillograph elements e and i; (b) oscillogram showing transients as the switch S opens and closes

period when the switch is open the discharge resistance functions to relieve the coil of its energy and have it ready for the next transient. The transient of building up and decaying will each occur once per revolution. This is shown in (b).

Stroboscopic Timing

For visual study a cathode ray oscilloscope is valuable to place the transient pattern in view. If the synchronous switch is not directly connected to the film drum it is sometimes useful to use a stroboscope to insure the proper synchronous relation between the motor driving the drum carrying the photographic paper and the motor driving the synchronous switch. The question might be raised why it might not be better to photograph the pattern made on the cathode-ray tube. In some isolated instances this may be desirable; however, since several traces are generally wanted, a magnetic type is more suitable if the transient is not too fast.

COMMERCIAL OSCILLOGRAPH adapted for retracing. Single-phase synchronous motor with gear has been substituted for the driving head and the shutter arrangement

THESE FWD MEN SPECIALIZE IN DEVELOPING TRUCKS THAT MEET THE EXTRA DEMANDS OF LINE CONSTRUCTION AND MAINTENANCE

A. G. Desens — *Sales Manager of FWD Utilities Division — with FWD for 18 years—assists FWD and Graybar's national organization of specially trained sales engineers in reducing line construction and maintenance costs through the proper application of FWD's 130 modern utility labor saving tools.*

Lloyd L. Pernot — *FWD Service Manager — with FWD for 10 years. Experienced as a machinist, a service man, a private truck owner and operator, a factory branch service manager. Knows how to make FWD trucks and equipment pay dividends. Helps FWD owners everywhere get the most out of their equipment.*

R. W. Rolseh — *FWD Parts Manager — with FWD for 14 years. Organized a nation-wide parts service to insure prompt replacement parts, available in any section of the country for all types of trucks or utility tools in use. Saves time and money by keeping equipment on the job for FWD users.*

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Utilities say — "An FWD line truck is a profitable investment if you use it just one hour per day."

A midwest utility reports — "165 holes dug in one day with an FWD."

FWD TRUCKS

104½-ft. Steel Tower "House-Moved"

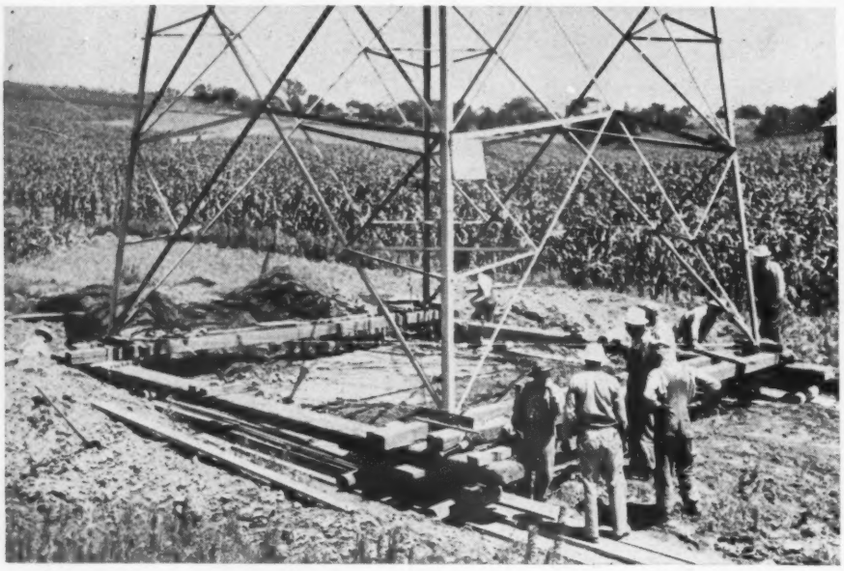
Tower Lines

An interesting problem was presented to the engineers and line crews of the Nebraska Power Company when a 6-ton, 104.5-ft. tall steel tower, 1.5 miles south of Omaha, had to be moved 86 ft. to a new location to make room for a four-lane highway to the new Martin Bomber plant at Fort Crook. At the same time clearance over the Union Pacific tracks had to be maintained.

The tower supporting two 66-kv. lines was moved intact with the six conductors and two lightning shield wires in place.

When the new concrete base and anchor posts were ready, a local house-moving crew came on the job to assist the company's line crew. Timbers and rollers were fastened to the tower's base and guy cables were installed at its top to steady it in case of high wind. The conductor clamps were replaced with wooden pulleys to hold the conductors in place, and then, by means of a winch line and an ingenious system of pulleys and "dead men," the tower was pulled to its new site by truck power.

All operations are reported to have functioned smoothly. The tower was fitted precisely into the new anchors and clearances over the tracks were found to be in accordance with safety rules.



TOWER at its new location, was "rolled" on plank pathway. Large timbers for skids were secured by steel plates on tower legs

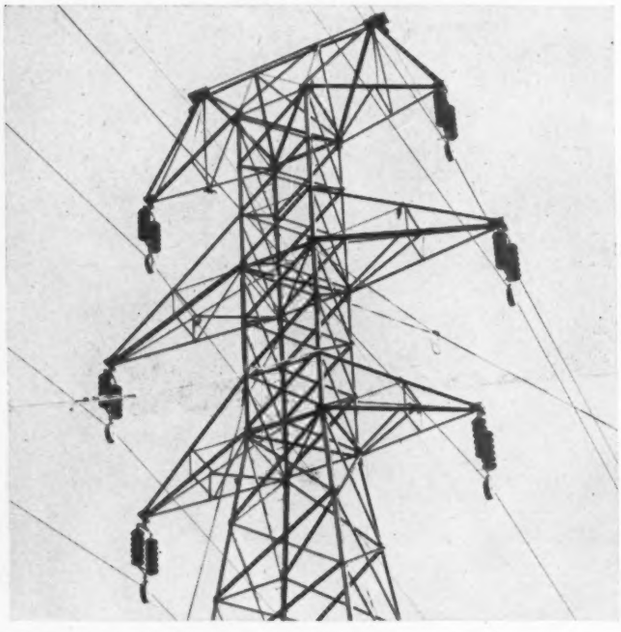
Pole Lines

Preservation of Pine Poles, Fir Crossarms

Preservative treatment using pentachlorphenol oil solutions has been found to be suitable for poles of many species of pine and Douglas fir as well as cedar poles (ELECTRICAL WORLD, July 26, 1941, page 122).

These pentachlorphenol oil solutions may be applied by pressure impregnation, or by some non-pressure process as soaking, dipping, spraying or brushing. One form of the preservative is a 5 percent solution of pentachlorphenol in light fuel oil. The toxicity or fungus killing concentration is 0.1 percent.

The solvent carrier may be varied considerably, depending upon the use requirements. For example, the sol-



WOODEN PULLEYS attached to insulators held suspended conductors in place while tower was being moved; circuit was dead only 48 hours

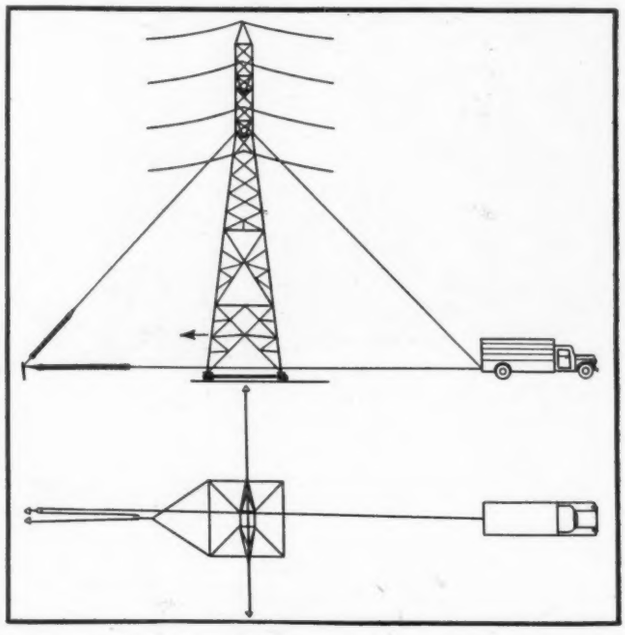


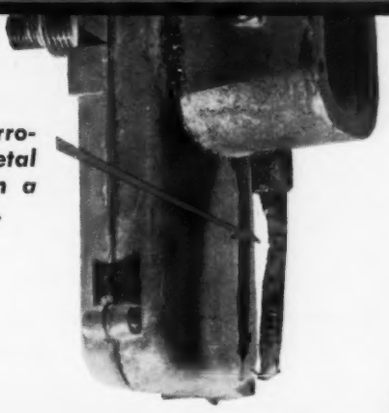
DIAGRAM of block and tackle system; tower rolls away from stationary truck, sustained upright by guy wires during the moving

THE HAYS CORPORATION

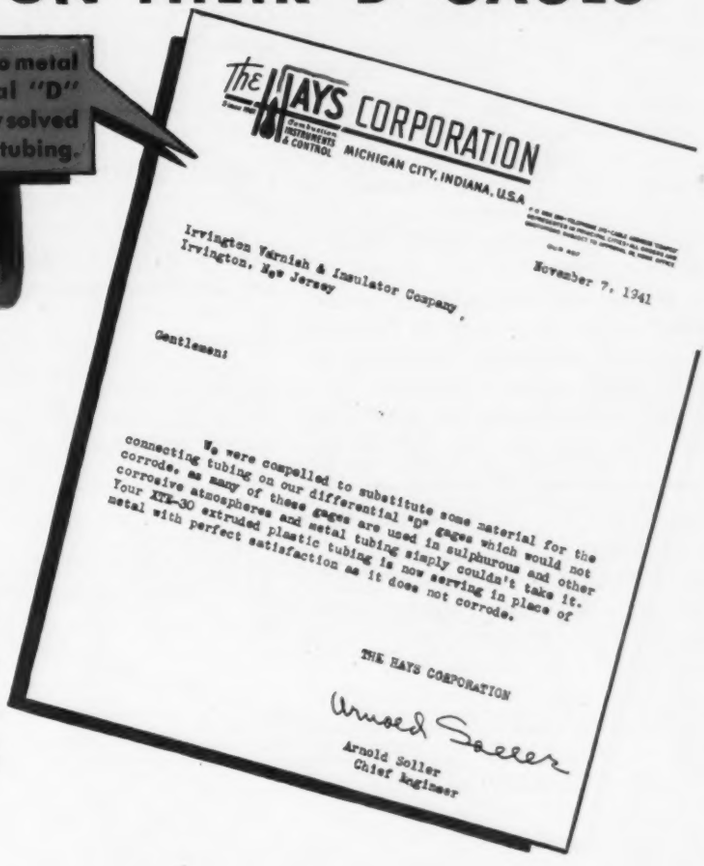
Since 1901 — Combustion INSTRUMENTS & CONTROL — MICHIGAN CITY, INDIANA, U.S.A.

USES CORROSION PROOF IRV-O-LITE PLASTIC TUBING ON THEIR "D" GAGES

The sharp teeth of corrosion were biting into metal connecting tubing on Hays Differential "D" Gages. Read how this problem was perfectly solved with IRV-O-LITE XTE-30 extruded plastic tubing.



Here's what corrosion did to the metal connection on a Hays "D" Gage.



THE HAYS CORPORATION
Combustion INSTRUMENTS & CONTROL MICHIGAN CITY, INDIANA, U.S.A.

November 7, 1941

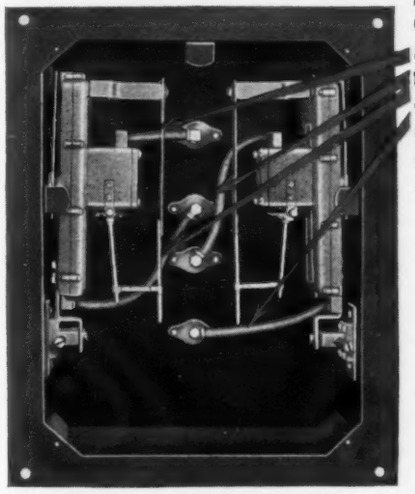
Irvington Varnish & Insulator Company,
Irvington, New Jersey

Gentlemen:

We were compelled to substitute some material for the connecting tubing on our differential "D" gages which would not corrode, as many of these gages are used in sulphurous and other corrosive atmospheres and metal tubing simply couldn't take it. Your XTE-30 extruded plastic tubing is now serving in place of metal with perfect satisfaction as it does not corrode.

THE HAYS CORPORATION

Arnold Soller
Chief Engineer



Now the "D" Gages connections are fully protected against corrosion by IRV-O-LITE XTE-30.

Test IRV-O-LITE XTE-30 yourself. We'll send you samples. Write Dept. 46

In addition to eliminating corrosion, your metal shortage problems can be met by using IRV-O-LITE XTE-30 plastic tubing as a substitute material. Try XTE-30 for replacement, it will give equally fine results and performance—may do an even better job as in the case of The Hays Corporation.

Also for electrical insulation, IRV-O-LITE XTE-30 extruded plastic tubing has high dielectric and mechanical strength, exceptional resistance to tearing, abrasion, heat, fire and solvents. Its extreme flexibility and smooth inside surfaces enables quick assembly on wires.

Irvington VARNISH & INSULATOR CO.

IRVINGTON, NEW JERSEY, U. S. A.

STANDARD OF THE WORLD — IRVINGTON INSULATION

PLANTS AT IRVINGTON, N. J. and HAMILTON, ONT., CAN.
Representatives in 20 Principal Cities

vents which have been used for the pressure treatment of Southern pine poles are described as "light to medium fuel or distillate oils, No. 1 to 5 in. The heavier and darker fuel oils, such as No. 4 and No. 5, are probably more satisfactory for poles, since they give the treated wood a desirable brown color, which adequately shows penetration, and further reduces the checking of the treated wood in service.

In pressure treatment the range of net retention of preservative recommended for Southern pine poles and crossarms is 8 to 12 lb. per cu.ft. No evidence of bleeding has been found in absorptions up to 12 lb. per cu.ft.

For soaking treatments the preservative should contain a plasticizing material of high solvency for pentachlorphenol, to prevent "blooming" or crystalization of the pentachlorphenol on the surface of the treated wood, which may occur in the case of soaking treatments, but rarely or never with pressure treatments.

Regarding Douglas fir crossarms, sufficient work has been done to indicate that effective preservative treatment can be accomplished by soaking two to four hours in a cold 5 percent solution. The absorptions average about 1½ lb. per cu.ft. and the pentachlorphenol is deposited in the vulnerable area at the pinholes.

Most fuel oils dissolve 5 to 7 percent of pentachlorphenol and some high aromatic petroleum oils will dissolve and carry up to 25 percent by weight of the chlorinated phenol. Concentrates are available, which can be used straight or diluted by cold mixing to furnish a solution of any desired concentration. One concentrate form contains 13.2 percent of pentachlorphenol in a plasticizing solvent, weighs 8.53 lb. per gal. and, when diluted with two parts by volume of light fuel oil, forms the 5 percent solution weighing about 7.4 lb. per gal. Another concentrate is available which when diluted with five parts by volume of light fuel oil forms a 5 percent pentachlorphenol solution which is sufficiently dark in color to give the treated wood a dark brown color and show penetration adequately.

Lead Cable Corrosion; Causes and Remedies

Underground Lines

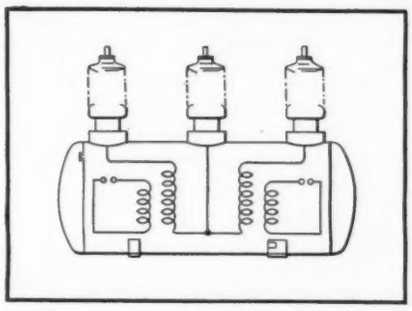
Corrosion of lead-covered underground cable—types, causes, tests and remedial measures—is summarized in the table below. Representing the opinion and experience of both light and power and telephone engineers, this compilation was presented at the recent Cincinnati meeting of the Edison Electric Institute's transmission and distribution committee by A. S. Brookes of Public Service Electric & Gas. It is part of a corrosion symposium being prepared by this committee of the E.E.I.

Type Of Corrosion	Causes	Tests or Observations	Characters of Corrosion	Remedial Measures
1. Stray Current—Anodic	Stray current in the earth picked up by the sheath which corrodes where the current leaves to return to earth. Stray current may be caused by (1) d-c trolleys and railways with grounded rail return systems; (2) faults on Edison 3-wire d-c systems. (3) other grounded d-c systems.	Positive cable-to-earth potentials with typical fluctuations in magnitude, correlated with current on sheath.	Corrosion pits contain little corrosion product. Corrosion products high in sulphates and chlorides. In severe cases brown lead dioxide may be formed.	Current drainage bonds to negative buses at substations to remove current metallically. At locations remote from substations, cathodic protection may provide the most economical solution. Improvements in railway systems to limit stray current. Repair faults and eliminate leakage on Edison 3-wire d-c systems.
2. Stray Current —Cathodic	High negative (cathodic) conditions resulting from stray currents, together with salts of sodium, potassium or calcium in the soil. Negative potential on cable sheath causes accumulation of strong alkalis which attack lead.	Usually not possible to predict where corrosion is occurring. A negative potential alone is not harmful, but may cause corrosion in combination with snow melting chemicals, etc., in some cases with potentials as low as 0.5 volt. Generally does not occur where sufficient water is present to dilute the alkali.	The corrosion product is lead monoxide, usually bright red, but may be green or yellow.	Reduction of negative potentials by rearrangement of current drainage bonds or improvement in railway system. Periodically flushing ducts to dilute and remove alkalis.
3. Dissimiliar Soil Effect	Earth currents set up by cables or other metalic structures, such as pipes, passing through dissimiliar soils such as clay and cinder fill. This is essentially a concentration cell with electrodes more widely separated. This action is produced by solutions from adjacent soils and is to be distinguished from the case of carbon particles in the duct (4).	Positive cable - to - earth potentials which may be present in the duct section and not noticeable in manholes.	Corrosion products, generally white (lead carbonate), are usually present. Attack may be of intercrystallin nature.	Cathodic Protection (forced drainage) to make cables negative and eliminate anodic electrodes of cells. May be supplemented by the use of corrosion protected cables, particularly for replacements after corrosion failures, and the coating of cables in manholes with an insulating paint. Zinc plates have been used in manholes with limited success.
4. Galvanic Corrosion	Different metals, such as solder and cable sheath, in contact in an electrolyte (soil water). Carbon particles from cinder fill washed into duct. Galvanic action may occur when cables are connected to a large buried copper structure such as a station grounding system.	In manholes corrosion can usually be detected by inspection.	Similar to stray current-anodic.	Eliminate galvanic couple where possible. In manholes insulating paint or water drainage may be effective.
5. Differential Aeration	Difference in oxygen content of electrolyte. Corrosion occurs where there is oxygen deficiency; under marlin ties, waste or mud on cables in manhole or under fireproofing. Can also occur at light metallic contacts, usually at edge of contact area.	Most corrosion is in or adjacent to manhole, and can usually be detected by inspection after removal of suspected waste, mud, etc. Usually such cells are a primary cause of corrosion only when cable is close to earth potential, say between + 0.1 and — 0.1 volt.	Corrosion confined to area under waste, mud, etc., or at edge of light metallic contacts.	Removal of material causing corrosion. Use of asphaltic coating under fireproofing.
6. Chemical Attack	Acetic acid caused by destruction distillation of wood (duct, shoring, etc.) usually at high temperatures due to presence of steam pipes. Strong alkalies from uncured concrete and other soil contamination. Usually not serious except in some locations where Douglas fir conduit has been used (acetic acid) and in fresh concrete (alkali).	Acetic acid difficult to detect as small amount may cause serious corrosion. Corrosion product usually lead carbonate. Other corrosive agents can be detected by chemical analysis of soil or corrosion product.	Evenly distributed attack as compared with pitting. Alkalies may produce yellow or red lead monoxide.	In the case of acetic acid, removal of the wood, reduction of temperature by heat insulation, etc. Acid present in duct must be neutralized by the introduction of ammonia gas, flushing, or other means. In the case of alkalies, eliminate the source of contamination.

New Development

Compressed Air Used for Insulation

Single-phase and three-phase voltage transformers generally combined with circuit breakers have been developed up to 38 kv. for using compressed air as an insulating medium. These compressed air transformers eliminate oil, compound fillings and



TWO 37-kv., single-phase compressed-air voltage transformers arranged for 2-watt meter metering

the like, according to Brown Boveri *Review* (Switzerland).

Primary and secondary windings are mounted concentrically and in order to subdivide the voltage drop the high voltage winding is itself subdivided into separate coils with a low voltage across each coil.

Ends of the high-voltage winding are carried through short leads to the high-voltage bushings, which have ceramic insulators. Both the high- and low-voltage bushings are doubly sealed and the seals maintain their tightness automatically.

Tanks are made of steel sheeting and welded. Accessory parts secured to the tank are: Compressed-air fitting with built-in check valve; manometer for the charge, and safety valve. Because of the high degree of insulation there is said to be no danger of a rise in pressure due to an electrical discharge or electric arc. The safety valve was added for additional safety in extreme cases of damaging phenomena occurring.

Compressed-air transformers can be connected, along with the air-blast high-speed circuit breakers, to an already installed compressed-air plant. When arranged for independent mounting the transformers are delivered charged to 14.5 kg. per sq.cm. gage. Tests have shown that they can be operated for years before the pressure drops to 12 kg. per sq.cm., which is the admissible minimum.

Another accessory is a special air drier which keeps the air practically dry when connected continuously with a compressed-air plant.

Meters

Arm Lifts Pen from Graphic Meter Charts

By J. H. MELVILLE
General Engineering Department
Florida Power & Light Company

Often circumstances make it desirable to prevent continuing a graphic meter record beyond a predetermined time even if an attendant cannot be there before that time. To accomplish this result a new device has been patented which performs the function automatically.

It consists of an extra pivoted arm extending under the pen arm and across the chart, a projecting end riding under the chart-holding nut. A slot in this nut is so adjusted in position as to let the arm ride under spring action and lift the pen from the chart at the preassigned time. The instrument can then be removed at

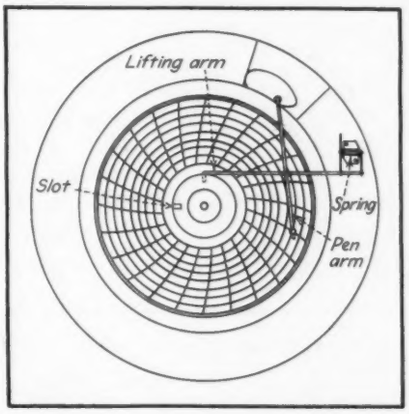
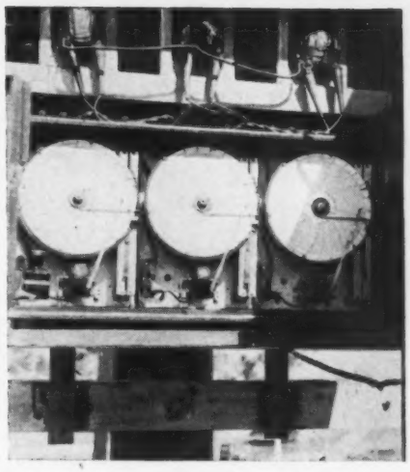


CHART-LOCKING UNIT acts as detent for pen-lifting arm

In locking up the chart the flange is so set as to have the slot release the lifting arm just before duplication of trace begins.

any convenient time without risk of doubled and garbled traces on the chart.

Use of this device avoids considerable cross-travel and gasoline consumption on the part of graphic meter installers. Customer relations are



PEN-LIFTERS attached to trio of Bristol voltmeters installed in pole box. Primary feeder-center record stopped at predetermined time

benefited in such ways as averting a Sunday call to remove a voltmeter chart placed on Saturday.

Protection

Fire Alarm Detects Incendiary Bombs

Fire detector units in most installations employ a low-melting alloy and are usually mounted at a suitable height in order to get the effect of the rising hot air from a fire. But that type of unit is of little use in the case of incendiary bombs. Heat from an incendiary bomb is intense, and local, and the effect is often more noticeable below than above it. Thus the fire-detecting equipment must be rapid in its response.

Incendiary bombs entering through the roof may probably be stopped by the first boarded floor. For such an event a high-speed fire detector equipment has been developed, according to *The Engineer* (London). It involves the use of a fire-detector wire and a relay alarm unit.

The wire has fusible inserts at every foot of its length. It is mounted on springs attached to each side of the building, is run continuously about an inch above the floor, and in a zigzag manner so that the distance between two adjacent wires will not exceed one foot.

When a bomb falls on the floor one or more fusible inserts will soften or melt immediately and interrupt a closed alarm circuit. If the insert softens the joint will separate because

the wire is kept under tension by the springs.

The detector wire forms a loop and is connected to the alarm unit, which is located conveniently for the fire warden or in a shelter.

A battery-operated alarm unit has a relay which when energized holds open the contacts to a bell or other audible signal. There is included also an "on" and "off" switch, a reset button for resetting the relay after an alarm and a test switch to check the operation of the alarm by opening the detector loop. If the battery voltage fails or falls below a predetermined value the alarm is sounded automatically.

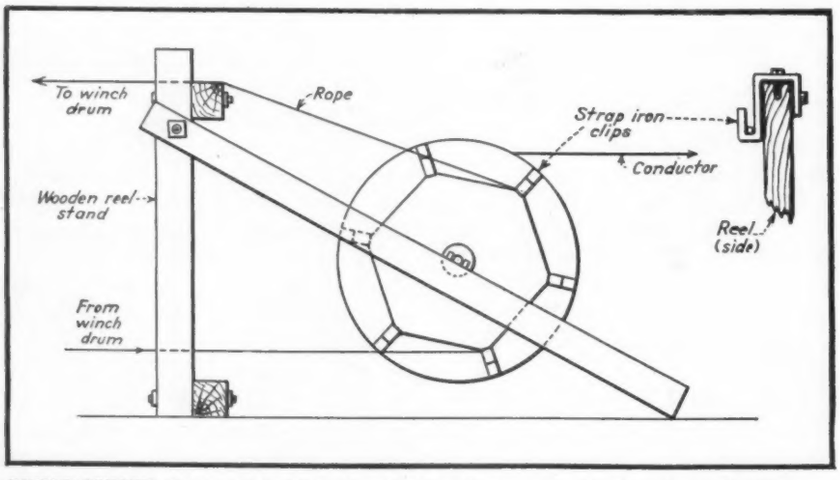
Other alarm units have a green indicator light for power supply and a red indicator light for a break in the detector loop. If the unit is switched on and neither light operates, but the alarm sounds, it indicates a failure of power supply.

Tower Lines

Rope Drive Powers Gathering Reels

Line crews of the Wisconsin Public Service Company, Green Bay, Wis., recently used an ingenious rope drive to power gathering reels in recovering copper from two high-voltage circuits abandoned with the completion of a loop circuit around Green Bay and DePere. The accompanying sketch shows essential elements of the system used.

Wooden reels on which the wire was gathered were mounted on improvised stands. One and one-half turns of an endless rope were passed around six steel "clips" fastened to one side of the reel. The other end of the rope loop was passed around the windlass on a truck winch drum. So powered, the reel pulled in the lengths of salvaged No. 2/0 copper which had previously been lowered from the steel transmission towers. Six conductors, each 4.7 miles in length, are being recovered in this manner.



TRUCK WINCH drives reels through rope loop to recover abandoned conductors

Underground Lines

Concrete Suggestions for Watertight Ducts

EFFECTIVE TOOL for vibrating concrete can be made from an old pneumatic drill by attaching a wooden plank to the drill head

In addition to vibrating all new concrete for duct lines to make it denser, and thus reduce water encroachment, Detroit Edison Company uses the following "tricks" to combat the action of water.

When a new concrete duct is to be located where ground waters are particularly bad from a corrosion standpoint anti-hydro or calcium chloride is mixed with the concrete to render it more impervious to water. In a particularly wet spot, where water might wash cement out of the mix or where soil is so sandy that it would absorb water from the mix, the bottom and two sides of the trench are lined with tar paper. This maintains the integrity of the mix and produces a sound and less porous envelope.

Industrial Power

Dry Motors in Damp Places

To keep windings of idle motors dry, such as motors installed in unventilated, wet locations (including those operating sluicegates in hydroelectric plants), a method has been developed to keep the motor warm, according to *Escher Wyss News*, Vol. 13 (Switzerland).

While the motor is inactive voltage is supplied to the motor terminals at a value considerably less than normal line voltage. The difference in voltage is absorbed with little loss by impedance coils.

Considering a squirrel-cage motor, two impedance coils bridge the motor switch at its terminals on two lines of a three-phase supply. When the switch is closed practically no current flows through the impedance coils. When the switch is open and the motor idle two phases of the motor windings receive a fraction of rated current through the impedance coils. Amount of current is determined so that the motor temperature will be slightly higher than the ambient temperature. Data for the impedance coils can be ascertained by the aid of a vector diagram.

In calculations for the impedance coil if the motor data are not available they can be obtained by a simple test and the values substituted in the following formula:

$$L = 10 \times F \times \Delta t$$

HOT ROLLED COPPER RODS
BARE AND TINNED COPPER WIRE
(IN ROUNDS, FLATS AND SQUARES)
BARE AND TINNED STRAND
URC WEATHERPROOF WIRE
COTTON, PAPER AND ASBESTOS MAGNET WIRE
(IN ROUNDS, FLATS AND SQUARES)
RUBBER INSULATED WIRES AND CABLES
TYPES R — RP — RH — RW
"SYNTHINOL" BUILDING WIRE
TYPE SN
"SYNTHINOL" MACHINE TOOL AND CONTROL WIRE
LEAD COVERED CABLES
TYPES RL — RPL — RHL
SERVICE ENTRANCE CABLES
"ROME 60" CORDS AND CABLES

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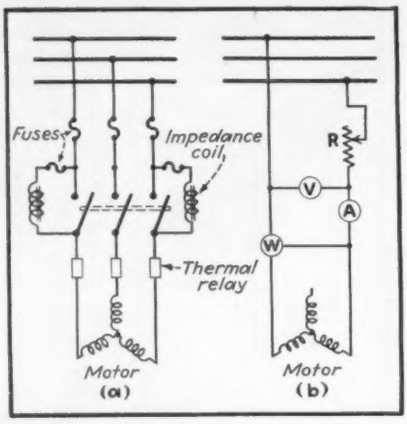


DIAGRAMS of connections

(a) Impedance coils bridge motor switch in open position, permitting small current to flow through two phases of the motor, to maintain a temperature slightly above ambient and keep the motor dry.

(b) Test connections for determining impedance coil data.

where L is the output in watts for the impedance coil, F the surface of the machine (measured in sq.m.) coming on contact with the ambient air, and $\triangle t$ is the difference in temperature between the surface of the casing and the ambient air measured in degrees C.

The test is made as follows: The motor is connected single phase to the three-phase circuit. With the aid of resistance R the calculated output L is regulated on wattmeter W, and the relative values of the voltage and current are read on the voltmeter V and ammeter A. Difference in voltage, E-e, must be absorbed in equal halves by the two impedance coils. Insulation of the coils must be as good as that of the motor windings.

Industrial Power

Power Selsyn Error Corrected

By W. F. MORSE
General Electric Company, Cleveland, Ohio

A recent investigation disclosed a condition that proves that equipment may operate successfully for many years but still be improperly connected or installed. Two adjustable-speed conveyors in a normalizing furnace were each driven by a d.c. motor with a power-Selsyn motor direct connected to each motor to maintain the two conveyors in synchronism.

For several years this equipment had operated perfectly, but at fairly low speed. It recently became necessary to speed up the conveyors; when approximately full speed of the motors was reached automatic synchronizing of the conveyors ceased to function.

In order for power Selsyns to produce synchronizing torque the rotor frequency should be greater than 20 cycles. Consequently, if the Selsyns are to be used near this normal synchronous speed they must be driven against their normal induction motor rotation. In this case the Selsyn stators had been connected to produce magnetic field rotation in the same direction as the rotors were driven by the d.c. motors. As long as the conveyor speeds were sufficiently below the synchronous speed of the Selsyns there was appreciable frequency in the rotor circuit and sufficient synchronizing torque was produced. But when the speed was increased the rotor frequency decreased, and finally a point was reached when no synchronizing torque was available.

Stator connections of the Selsyns were changed so as to produce magnetic field rotation in a direction opposite to the rotor rotation, and consequently adequate rotor frequency to produce torque was available at all speeds. The user was amazed to find how such intricate electrical difficulties can be remedied by simple changes and was pleased no end to find performance satisfactory from equipment he had been about ready to discard.

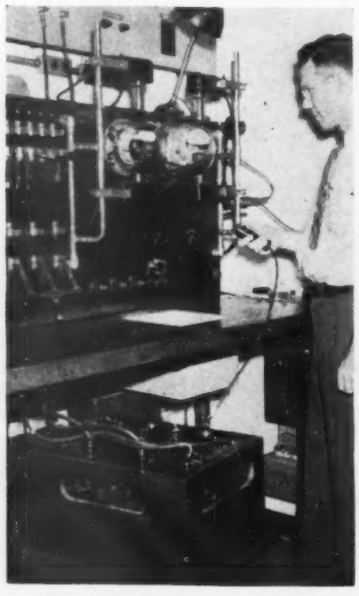
Meters

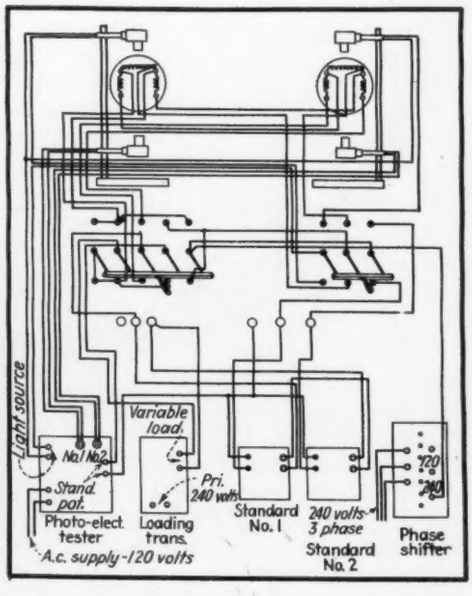
Photo-electric Device Speeds Meter Test

Electric meter shop of the Wisconsin Public Service Corporation, at Green Bay, has doubled its testing rate for socket type meters by fitting one of its States meter testing load panels with two meter sockets and mounting separate G.E. photo-electric revolution counters at each socket position.

With this arrangement the meterman is able to turn one meter over to the photo-electric counter while he is adjusting the second. The counter automatically stops the rotating standard after any pre-set number of revolutions of the meter under test. Once the counter has been set in operation the tester is free to perform any other task required.

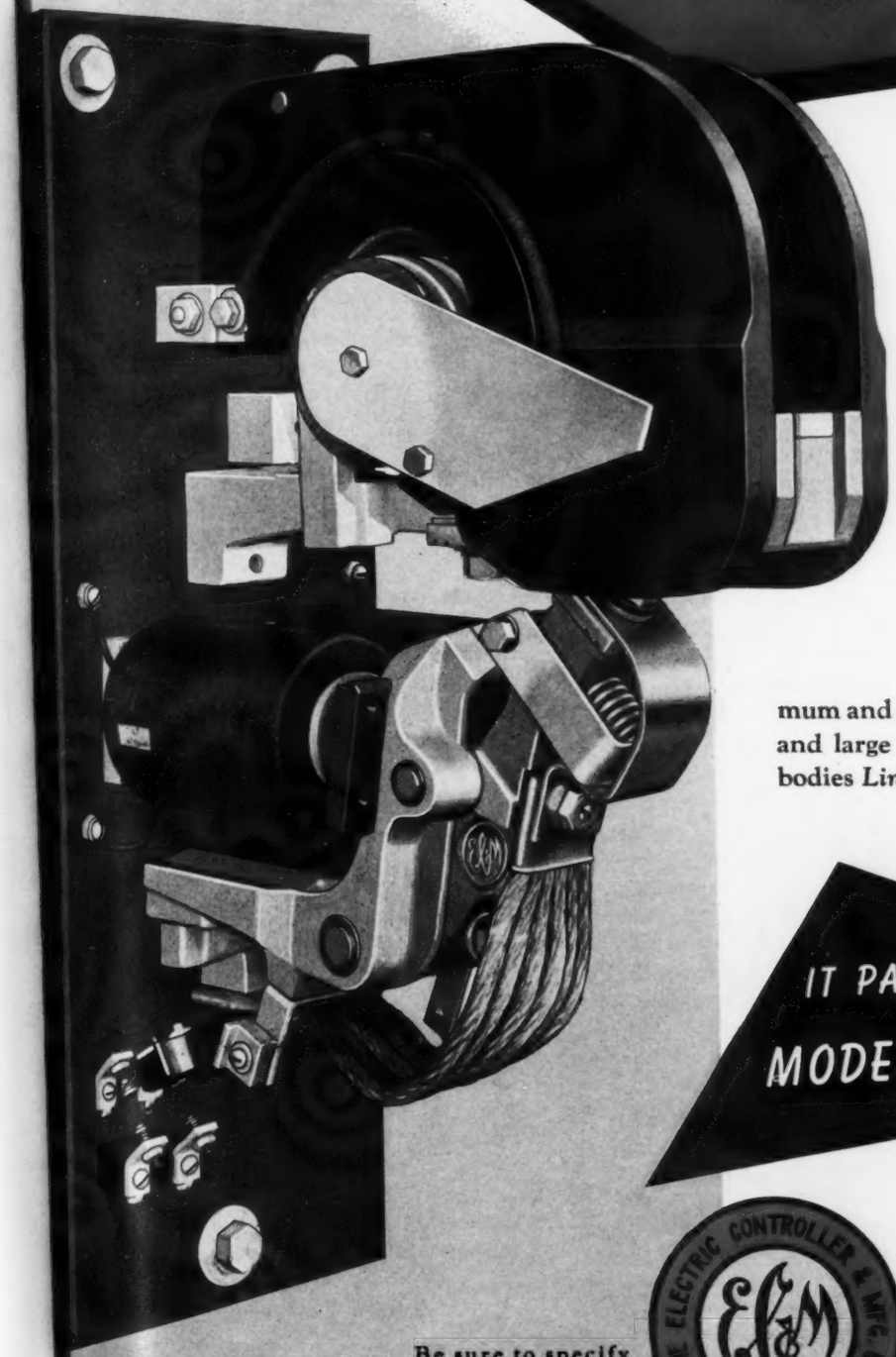
A switching arrangement, shown in the accompanying diagram, permits the meter technician to test either the left- or right-hand element of either meter individually and separately without making any change in connections on the face of the test panel. Selection of the meter and the element to be tested is made by two-position selector switches on the face of the board. This method of testing watt-hour meters completely eliminates the old type "start and stop" switch which is being demonstrated in the picture.





STANDARD METER testing load panel adopted for photo-electric testing of socket meters (left). Switching arrangement selects meter and element to be tested (right)

WORLD'S FASTEST 600 AMPERE CONTACTOR for D-C Service TO HELP GET MORE Steel Production

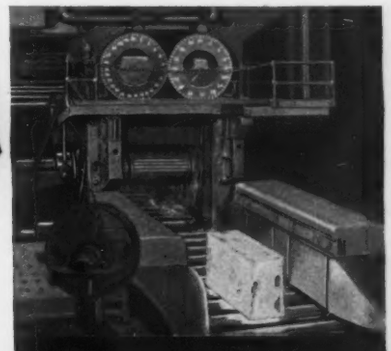


The faster response of this EC&M Contactor results in *greater accuracy* in spotting crane loads, fewer applications of down-power, reduced number of bridge and trolley motions—*faster positioning* of screwdowns, sideguards, manipulator fingers, etc. . . . briefly, *an aid to make '42 a record year.*

Offers Many Outstanding Features

This new EC&M Magnetic Contactor is 50% faster than the previous 600 ampere contactor, has a 2-position adjustment permitting over ½" contact-wear, is designed with highly efficient magnetic circuit, keeping leakage flux at minimum and inductance down, has powerful magnetic blow-out and large arc shield for highly inductive circuits, and embodies *Line-Arc* principle.

IT PAYS TO MODERNIZE



A prominent steel company recently increased production by over 9,600 tons per month through modernization. Among the new equipment were EC&M Controllers for all auxiliary drives—tables, sideguards, screwdown, manipulators, etc., of this mill.

Be sure to specify EC&M *Line-Arc* Contactor Control for d-c cranes and mill auxiliary drives.

THE ELECTRIC CONTROLLER & MFG. CO. E&M CLEVELAND, OHIO

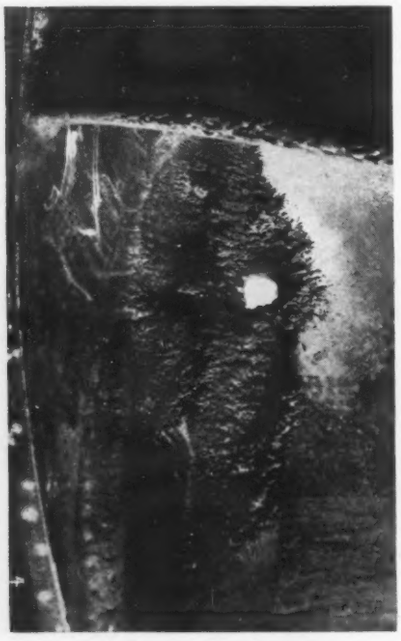
THE ELECTRIC CONTROLLER & MFG. CO.

Metal Spraying Repairs Hydro Turbine Runners

By E. A. WOODHEAD
Superintendent of Power Plants
Idaho Power Company

Hydro Plant

TURBINE RUNNER from 13,000-hp. machine showing pitting plates that cut down output capacity by 4 percent



PITTING PLATE removed, showing cavitation that is repaired by welding and metallizing

Metallizing or metal spraying has been successfully adopted by this company for repairing turbine runners that have been seriously impaired due to cavitation. A recent noteworthy example of this technique was the repair of the 13,000-hp. American Falls plant turbine runners. Some years ago the pitted areas of these machines were covered with cast bronze pitting plates as shown in the accompanying illustrations. Subsequent tests showed that these constricted the water flow and reduced the capacity of the machines by approximately 4 percent. Recently these plates were removed and the cavities filled by the metallizing method now used wherever practicable on the system.

Welded Fill First

In this technique, all holes are first filled flush with the pressure face of the runner by welding in fitted plate inserts. The rough surfaces are then dressed down to approximately 70 percent of the depth of the cavity by removing pinnacles and ridges with a pneumatic chisel. The runner vanes and outer rim are then heated to a temperature approximately 20 deg. F. above room temperature and held until the job is completed. All indications of oxidation are removed by sand blasting.

Each surface that is to be covered is prepared for application of the molten metal spray by blasting the surface with steel shot at air pressures of 100 to 120 lb. per sq.in. This provides indentations at slightly varying angles so as to assure a satisfactory interlocking of the new metal to the parent metal surface. This is highly essential.

New metal of a type offering greater resistance to the effects of cavitation than the parent metal is then sprayed over the surface that is to be covered.

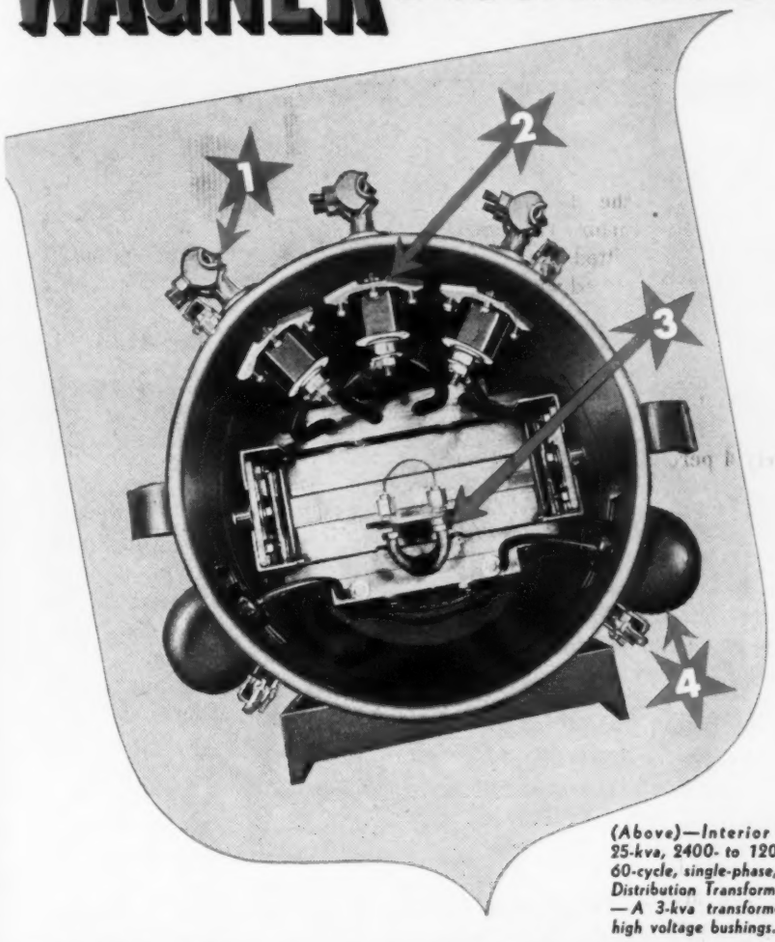
Satisfactory results have been obtained by using 18–8 to 25–14 chrome nickel steel.

Experience has shown that the new surface thus formed has all of the characteristics of cast iron except elongation, ductility and tensile strength. This company does not hesitate to use the technique for water wheel pitting repair and for any other applications where it will not be subjected to sharp impacts, rugged abrasions, continuous pounding or edge strains, since hardness, wear resistance, compression and corrosion resistance are retained to a high degree.

PITTED AREA during course of covering by metallizing process in which molten metal is sprayed on surface previously prepared by blasting with steel shot

For best results strict attention must be paid to a few essentials. For instance, if all areas to be metalized on a turbine runner have been prepared at once, care should be taken that metal vapor dust does not settle on surfaces not yet sprayed. Proper air pressure, proper distance between metal spray gun and work, proper rate of feed and the relationship between melting temperature of the two metals for the given job must be determined in advance. The experienced operator will always do this. Also, there is much less hazard in blasting on molten metal to form new surfaces where the melting temperatures of the two metals are close. To place a covering of chrome nickel steel with a melting point of 1,600 to 2,000 deg. F. on bronze with a melting temperature of 1,000 deg. F. is a difficult operation. However, it can be done successfully if proper care is used.

Examine the Features of this WAGNER Distribution Transformer

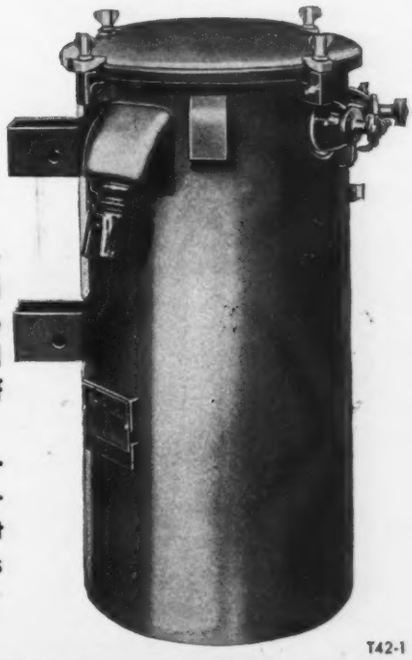


1 Solderless connectors on all bushing terminals make installation easier. The insulation level of the bushings and windings are so coordinated as to cause abnormal line surges to flash over the bushings on the outside of the tank.

2 Each bushing is of the removable type, held in place in a fixed position by means of a clamping ring assembly.

3 Disc type interchanging device consists of taps terminating in studs fastened in a bakelite disc.

4 The one-piece copper-bearing steel bushing-pocket is welded to the tank wall.



(Above)—Interior view of a 25-kva, 2400- to 120/240-volt, 60-cycle, single-phase, type HEX Distribution Transformer. (Right) —A 3-kva transformer showing high voltage bushings.

T42-1

The high efficiency and remarkable stamina of Wagner transformers is the result of fifty years of constant research and improvement. Every Wagner transformer built today has the full benefit of those fifty years of transformer engineering and manufacturing experience in building all types and sizes of distribution and power transformers.

In addition to the conventional types, Wagner makes transformers for special types of service, such as NOFLAMOL (Non-inflammable, liquid-filled) transformer and the type Y-H Constant Current Regulator for series street-lighting systems.

COMPLETE LITERATURE WILL BE SENT UPON REQUEST • •

Wagner Electric Corporation
6400 Plymouth Avenue, Saint Louis, Mo., U.S.A.
TRANSFORMERS • MOTORS • BRAKES • FANS

LOAD BUILDING

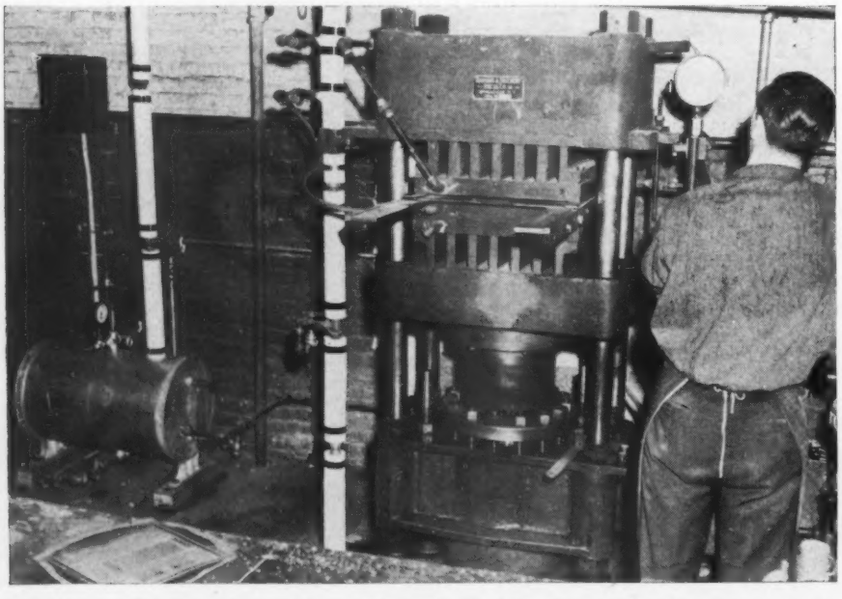
Electric Steam Molds Rubber Plates

By the installation of a 12-kw. electric steam generator in its printing plant at Waltham, Mass., C. W. Potter, Inc., was enabled to mold its own rubber plates on a production basis in eight hours, which permits keeping the presses running for a 24-hour stretch when conditions thus require.

These rubber plates are used largely in printing business forms and are molded by placing a sheet of specially prepared rubber on a die, and then putting both in between the platens of a hydraulic press. The press accommodates three platens and the press operates at 15 to 20 tons pressure. Standard platens are 20x 20-in. and 2 in. thick.

The steam pressure used must be accurately controlled in order to keep the platens constantly at 307 deg. F. Formerly steam from the building mains was used to heat the press, but this was unsatisfactory because of wide pressure fluctuations, which in turn caused temperature irregularities.

The electric steam boiler was provided by the Commonwealth Electric Manufacturing Company, Boston, and has a rating of 36 lb. of steam per hour at 70 lb. per sq.in. About ten minutes is required for each batch of platens to undergo press molding. The boiler is well insulated, has an electric immersion unit, pressure control, relief valve, automatic low water cut-off, and water level indicator. Offering a 100 percent power-factor load, it is desirable from the Boston Edison standpoint, the utility supplying energy to the establishment. It is of maximum convenience to be able to operate the press at any time, Sundays, holidays or nights, entirely independent of the building steam supply.



PRESS for molding rubber printing plates is supplied with steady steam from electric boiler at left

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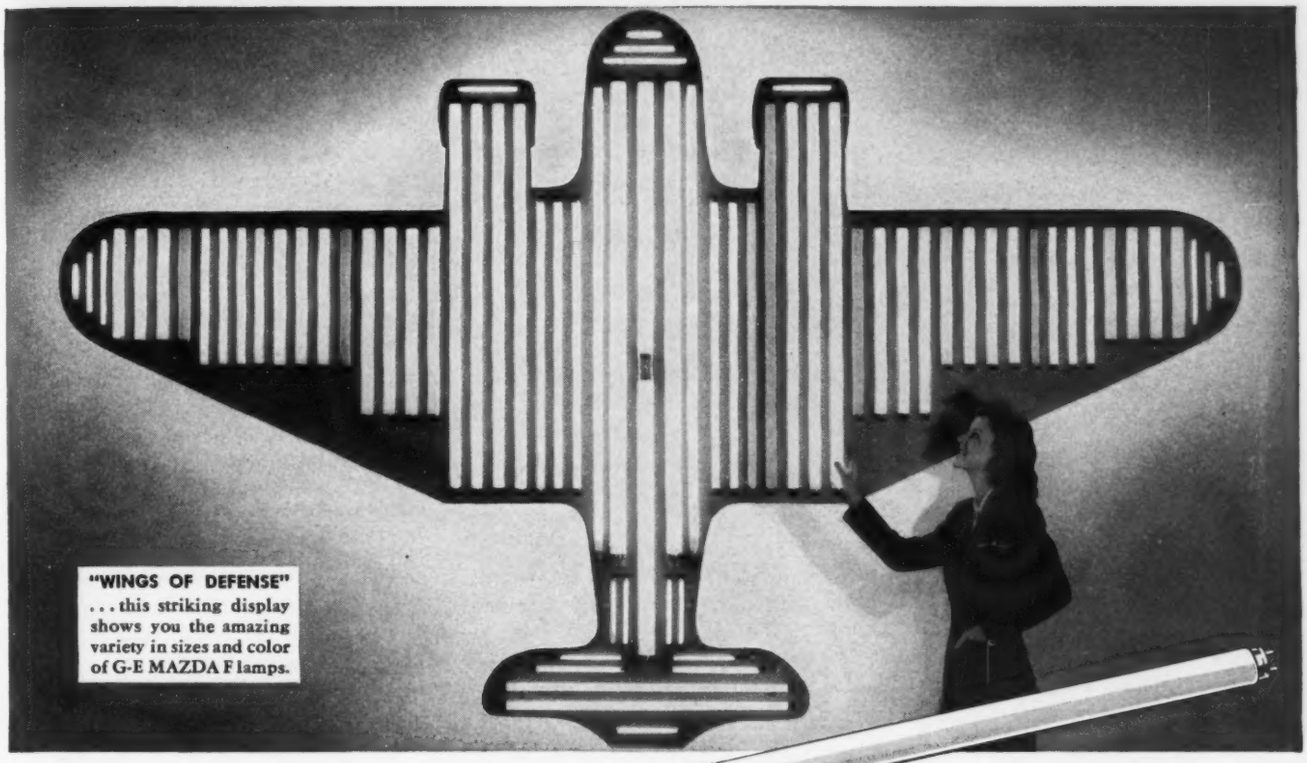
Sterilamps Benefit Dining Car Service

The recent installation of a beef tenderizing process at the dining car supply depot of the New Haven Railroad at Boston, Mass., has brought about striking economies. Combining refrigeration, air conditioning and sterilization, the plant enables the railroad to order its beef only four days ahead of consumption in comparison with the former practice of six to ten weeks' advance buying. The treatment is provided by the Westinghouse "Tenderay" process, utilized in connection with close control of temperature and humidity. The installation was designed and put in by J. J. and W. J. McDonald, Boston hotel and restaurant engineers, electric service being furnished by Boston Edison.

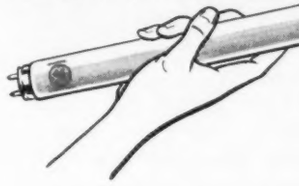
The principles of operation are now fairly well known in industry. In the New Haven's application 35 dining cars are serviced from this supply point. The beef is first processed for two days at about 60 deg. F. at 85 to 90 percent relative humidity, in a compartment capable of holding 1,000 lb. This is equipped with two 30-in., 27-watt Sterilamps and three 350-watt strip heaters, besides suitable spray facilities for humidifying.

Following this, two more days time is required in the storage room (capacity 5,000 lb.), which has six 27-watt Sterilamps and which is maintained at 35 deg. F. A ¼-hp. York compressor provides the necessary cooling and the installation in-



"WINGS OF DEFENSE" . . . this striking display shows you the amazing variety in sizes and color of G-E MAZDA F lamps.

Because more and more folks want these lamps



●The ever increasing demand for G-E MAZDA F (Fluorescent) lamps has resulted in many manufacturing economies in our fluorescent factories. In line with long established General Electric policy, these savings are passed along to our customers through the reduced prices on G-E MAZDA F lamps announced below, effective January 1, 1942.

This reduction marks another step in the downward trend of the cost of Better Light for Better Sight. (Since G-E MAZDA F lamps were first introduced in 1938 prices have been reduced as much as 60%). It is particularly significant now, since so many of these lamps are being used to supply cool, efficient "indoor daylight" for defense industries . . . to speed production, cut down waste and protect the eyesight of defense workers.

Effective January 1, 1942

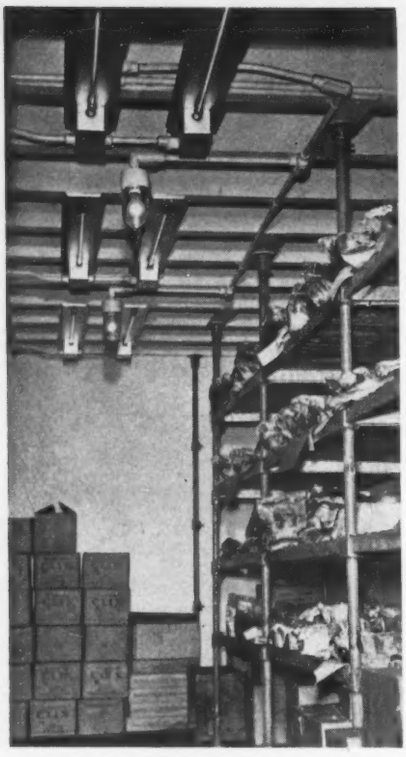
NEW LOW PRICES ON G-E MAZDA F LAMPS

14-watt T-12	was	90c	NOW	80c
15-watt T-8	was	75c	NOW	65c
15-watt T-12	was	95c	NOW	80c
20-watt T-12	was	95c	NOW	80c
30-watt T-8	was	95c	NOW	80c
40-watt T-12	was	$1.35	NOW	$1.15
100-watt T-17	was	$3.00	NOW	$2.60

Above prices refer to daylight and 3500° white.
Prices also reduced on soft white and colored G-E MAZDA F lamps.

G-E MAZDA LAMPS

GENERAL ELECTRIC



SIX Sterilamps (shown on ceiling) play an important part in 20 percent food saving secured by New York, New Haven & Hartford Railroad in its dining car servicing headquarters at Boston, Mass. Storage room installation, shown above, supplemented by second installation located in processing room

cludes a 65-watt circulating fan. Automatic control is featured.

Harold Quinlan, superintendent of the dining car department, estimates a saving averaging 20 percent in beef, due to the absence of mold and prevention of dehydration, or loss of juices which would cause shrinkage. The relatively high temperature speeds up the action of enzymes, rapidly changing the fibrous texture of the beef to a gelatinous compound without alteration of flavor. Orders for beef have increased in the dining car service since the installation was made.

•

Infra-Red Dries Pottery Glaze

Joaquin Potteries, Stockton, Calif., manufacturer of fine tableware, recently remodeled its plant, installing two Pomona gas-fired continuous kilns to replace the batch-type kilns formerly employed. Then the drying of the glaze dip, prior to firing, proved a bottleneck to the increased production offered by the continuous kilns.

Solution was the adoption of infra-red drying lamps in two different installations. The tunnel drier, shown in the accompanying illustration, handles the smaller pieces, such as cups and saucers, with its 60 250-watt lamps. Larger pieces are handled by the rotating table, also illustrated here, with drying equipment consisting of 44 similar lamps.

Ware is hand dipped and deposited on the slowly moving racks. After the infra-red exposure they are dry enough to stack. Experiments with lamps above and below the moving rack showed that penetration of infra-red heat was such that the bottom lamps were not required.

The two driers have been in practically continuous use—sixteen hours per day, six days per week—since they were installed early last year. While the operating cost of about $4.50 per day is probably more than for a fuel-fired drier, it has proved much more satisfactory in operation. Even the redipped ware, which has previously been fired, filling up all the pores in the surface, and which has developed some imperfections in the finish, can be dried sufficiently to be handled after one trip under the lamps. On a Monday morning the ware travels directly from the drier to the kilns with satisfactory results. The balance of the week it has a further chance to harden while standing on trays awaiting its turn at the kilns.

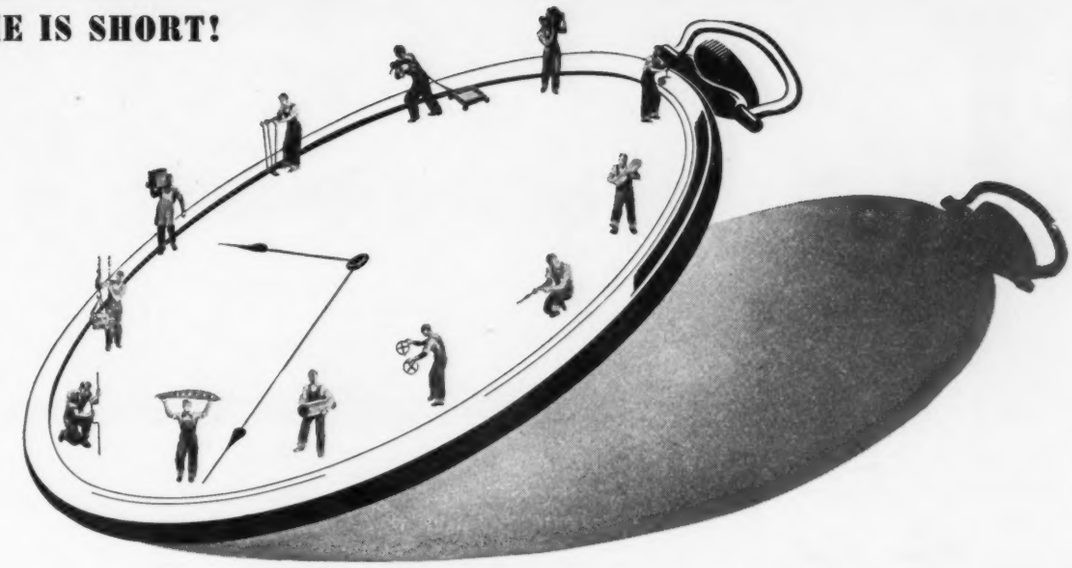
Operating Advantages

M. J. Lattie, president and general manager of Joaquin Potteries, says that in comparison to the conventional method previously employed by the industry, of passing the ware through a tunnel heated by radiant fire heaters tipped over the traveling conveyor, he is able to use wooden conveyor construction, the room temperatures are kept much lower in summer, and there is no necessity to vent combustion fumes and moisture. In consequence, the process is visible throughout its travel, and there are almost no returns of ware for redipping and drying. There has been a saving in floor space, and the drier installation is flexible enough to be placed in the most convenient point in the production line. The increased electric cost has been more than justified and an additional installation of 40 more lamps is probable shortly. Installation is served by Pacific Gas & Electric Company.

TUNNEL DRIER, consisting of 60 250-watt drying lamps mounted in standard gold-plated reflectors

ROTATING TABLE, with drying equipment consisting of 44 250-watt lamps, handles larger pieces

TIME IS SHORT!



8,760 HOURS TO GO IN '42

Men, make the most of them!

A MILLER Continuous Wireway Fluorescent Lighting System can pack more production to the man-hour in your customers' plants

January 1, 1942 . . . 8,760 hours to go! Golden, *going* hours. Hurry! Hurry!

Industry must put all machines to work. Work machines all the time. Use the most efficient methods. Build an adequate working force. Keep the working force at work.

You can help industry squeeze the last drop of production from each priceless hour by specifying the *proven* value of continuous-row fluorescent lighting, MILLER 50 FOOT CANDLER and 100 FOOT CANDLER. (MILLER TROFFERS for offices and drafting rooms.)

You can help point up the efficiency of its man-power with 50 foot candles or better of matchless working light . . . as many defense plants have done already.

That's why you will find it worthwhile to have all the working details of the MILLER Continuous Wireway Fluorescent Lighting System always on tap. Write today. *(Representatives in principal cities.)*

Be sure your customers get these 5 MILLER benefits when they buy fluorescent lighting

(1) **HIGHER ILLUMINATION—UNIFORM DISTRIBUTION** . . . 50 to 100 foot candles for faster, better production and greater worker efficiency. Production equipment can be moved without changing lighting.

(2) **30 TO 50% LOWER INSTALLATION COSTS** . . . Fixtures contain up to 80% of necessary conduit in continuous wire channels—make defense dollars go further.

(3) **FASTER INSTALLATION** . . . Steps up building schedules — goes in with minimum labor—plants get into production quicker.

(4) **SIMPLIFIED MAINTENANCE** . . . Easy to clean, removable porcelain-enamel reflectors—save valuable man-hours for production.

(5) **ALLOWANCE FOR FUTURE LIGHTING NEEDS** . . . Illumination increases up to 45% practical without new fixtures—completely flexible for greater or less light as needs demand—lower obsolescence.

MILLER

50 FOOT CANDLER
100 FOOT CANDLER
MILLER TROFFERS

Continuous Wireway Fluorescent Lighting Systems

THE MILLER COMPANY
MERIDEN, CONN.

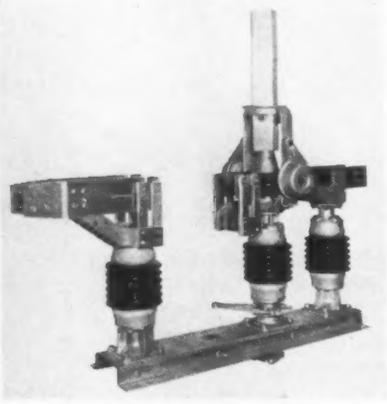
Pioneers in Good Lighting Since 1844

● **MILLER offers a complete line of filament and fluorescent lighting equipment.**

NEW EQUIPMENT

Switch

New switch has a square copper tube blade which, by means of a 45-deg. bearing mounted on top of the center rotating



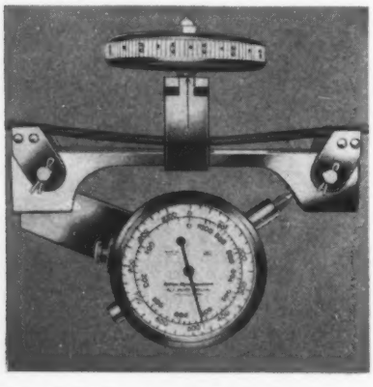
Square copper tube blade switch (s.p. unit illustrated); 3-pole, 3,000 amp., 23 kv. **Delta-Star Electric Co.**, 2400 Fulton St., Chicago, Ill.

insulator unit, is raised or lowered. Same movement also turns the blade corners into high pressure connection with fixed contacts at both blade ends. Coiled springs inclosed in circular housings at the hinged end of the blade counterbalance it.

•

Dynamometer

New type of dynamometer when used as a shunt instrument (illustrated) indicates



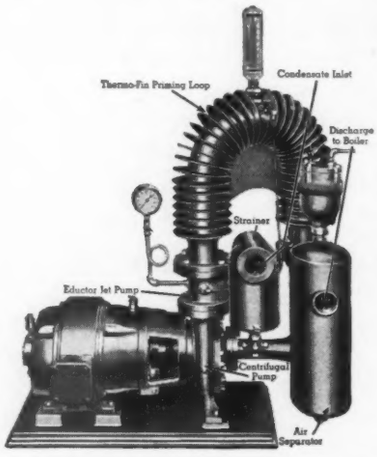
Combination shunt-traction dynamometer; capacities 750 and 1,000 lb. **W. C. Dillon & Co., Inc.**, 5410 W. Harrison St., Chicago, Ill.

tension on an established wire, guy or strand, after graduated wheel on a clamp is set to size of wire being checked. As a traction instrument (clamp is removed) it indicates tension applied to wire in process of erection, and is used with shackles, block and tackle.

•

Condensate Return System

Eductor principle of operation insures thorough condensate and air removal from process apparatus making increased production possible by maintenance of uniformly high temperatures, it is claimed. After expulsion of the air from the closed circuit, the condensate is returned to boiler at temperatures close to that of



Cochrane-Becker high-pressure condensate return system. **Cochrane Corp.**, 17th St. and Allegheny Ave., Philadelphia, Pa.

process without flash loss, said to provide 1 percent fuel saving for each 11-deg. temperature gain.

•

Dust Collector

"Dustkop 600" portable unit-type dust collector; rated capacity 600 cfm., equipped with ¼-hp., 3,450-r.p.m., 110-volt, single phase motor. **Aget-Detroit Mfg. Co.**, 958 Book Bldg., Detroit, Mich.

Added to the company's line of dust collectors is a selfcontained unit, said to provide a waterlift of approximately 3.3 in. Two lengths of 2-in. flexible rubber hose completes the connection between the unit and machine such as a grinder. Filters are of the spun glass variety.

Rectifiers

New line of high-voltage electronic rectifiers use cold cathode type tubes. On standard models, polarity can be reversed

Electronic rectifiers; 20, 50, 100 (illustrated) and 200 kv., with a current range from microamperes to milliamperes, operate from 110-volt a.c. supply. **Slayter Electronic Corp.**, Newark, Ohio.

in a few minutes, can be turned on and used immediately and operated continuously on full load, it is claimed. Entire unit is housed in a grounded metal case, with necessary metering devices built in.

•

Blackout Flashbulbs

"No. 5-R" and "No. 22-R" blackout photoflash lamps; identical in size and shape with No. 5 and No. 21 photoflash lamps. **General Electric Co.**, Nela Park, Cleveland, Ohio, and **Westinghouse Elec. and Mfg. Co.**, East Pittsburgh, Pa.

Two sizes of blackout photoflash lamps have bulbs with special purplish-black coating, to permit taking of pictures at night. Characteristic of coating is its ability to screen out visible light yet to let the infra-red, or heat rays, through to flood the subject with invisible radiation. Infra-red film is used for the picture. Lamps are available for newspaper, Army and Navy photographers.

BUYING ELECTRICAL EQUIPMENT?—McGraw-Hill's *Electrical Buyers Reference* is a convenient place to look first for manufacturers' product data, names and addresses.

NEWS ABOUT PEOPLE

Baily Assigned Broader Duties in Brooklyn

Edward A. Baily has been elected vice-president, a member of the board of directors and assistant to the vice-chairman of the board of the Brooklyn Edison Co. He succeeds Walter P. Holcombe, who has retired because of the company's 65-year age limit. Mr. Baily has been treasurer of the company.

Mr. Baily's career with Brooklyn Edison goes back to 1905, when he joined the Edison Electric Illuminating Co. of Brooklyn and the Kings County Electric Light & Power Co., predecessors of Brooklyn Edison, as secretary to W. W. Freeman, vice-president and general manager of both companies. He continued to serve in the same capacity to Mr. Freeman's successor, Walter F. Wells.

In 1917 Mr. Baily was appointed secretary of the Edison Electric Illuminating Co. of Brooklyn and a year later, after company mergers, secretary of the Kings County Electric Light & Power Co. and of the Amsterdam Electric Light, Heat & Power Co. In 1920 he became treasurer of the Brooklyn Edison Co., which had changed its name from the Kings County Electric Light & Power Co. the previous year. A year later he was appointed treasurer of the Amsterdam Electric Light, Heat & Power Co. and the following year was elected a director and appointed treasurer of the Edison Construction Co.

Mr. Holcombe first joined the Brooklyn Edison Co. 21 years ago as a purchasing agent. His success in reorganizing purchasing department operations resulted in his being made vice-president in charge of purchasing and transportation in 1926. He was elected vice-president and assistant to the vice-chairman of the board in 1938.

E. A. Baily

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Buchanan Succeeds Babb as Allis-Chalmers Head

W. C. Buchanan has been elected president of Allis-Chalmers Manufacturing Co. to succeed Max W. Babb, who became chairman of the board. Mr. Buchanan had been a director and member of the executive committee. He will continue as president of Globe Steel Tubes Co. Mr. Babb, president since 1932, followed the late Gen. Otto H. Falk as board chairman. General Falk died in 1940.

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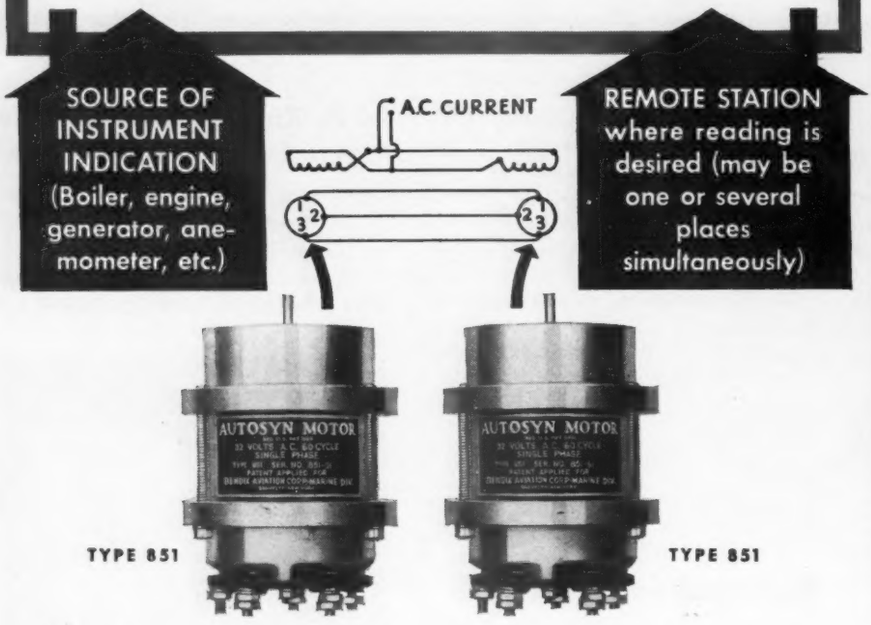
▶ DR. WILLIAM D. COOLIDGE, vice-president of the General Electric Co. in charge of research and director of the G. E. research laboratory in Schenectady, has been awarded the Duddell Medal of the Physical Society in London. Official notification of the award is given in a letter received from Sir Owen Richardson, foreign secretary of the society. In making the award to Dr. Coolidge, Sir Owen wrote, the society's council "had in mind your achievement, as long ago as 1909, in producing ductile tungsten from the powdered metal, and the development about 1913 of the heated-filament-cathode X-ray tube which is everywhere known by your name."

L. H. Knapp Assumes New Duties in Pawtucket

Lester H. Knapp, whose appointment as vice-president of the Blackstone Valley Gas & Electric Co., Pawtucket, R. I., in charge of electrical operation and sales activities, was noted in ELECTRICAL WORLD, December 27, 1941, page 91, was graduated from the University of Minnesota as an electrical engineer in 1912. After a year of high school teaching he was employed by the Mississippi River Power Co. on the construction of the hydro-electric dam at Keokuk, Iowa. In 1915–16 he was superintendent of the Missouri Transmission Co., St. Louis, and from 1917 to 1920 general superintendent of the Houghton County Electric Co. in northern Michigan.

He returned to Keokuk as assistant general superintendent of the Mississippi River Power Co., and in 1924 became sales manager of the Paducah (Ky.) Electric Co. His successful work in the above Stone & Webster properties led to his transfer in 1925 to the Blackstone Valley company as chief industrial service engineer in charge of commercial and power sales, contracts, rates and heating.

How to provide remote readings of almost any instrument—*efficiently, reliably and simply*


SOURCE OF INSTRUMENT INDICATION (Boiler, engine, generator, anemometer, etc.)
A.C. CURRENT
REMOTE STATION where reading is desired (may be one or several places simultaneously)
AUTOSYN MOTOR
AUTOSYN MOTOR
TYPE 851
TYPE 851

Just use a pair of

BENDIX-CORY AUTOSYN

SELF-SYNCHRONIZING SIGNALING UNITS

WHEN it is desirable to be able to read an instrument indication at a distance from its source—perhaps at more than one point simultaneously—Bendix-Cory Autosyn provides the simplest, surest means ever devised. Wired as shown above, the armatures of both "motors" move in unison within an accuracy range of 1° plus or minus (½° on special order). The character of the indication to be transmitted makes little difference—it may be pressure, rate-of-flow, count, dimension, liquid level, voltage, amperage, resistance, temperature. Bendix-Cory Autosyn units are made in several sizes and types. Type 851 (illustrated) produces 2.5 inch-ounces of torque at 90° angular displacement—safe continuous operating torque 1.1 inch-ounces—dimensions 2⅜" x 3 15/32". One transmitting unit can actuate several variously located receiving units. Autosyns are standard for industrial instrumentation systems. Interested engineers are invited to write—

BENDIX AVIATION CORPORATION
MARINE DIVISION 754 Lexington Avenue, Brooklyn, N.Y.

West Elected President of Worcester Utility

John West, for the past seven years regional executive of the New England Power System, Boston, has been elected president of the Worcester County Electric Co., Worcester, Mass., succeeding Thomas G. Dignan, recently elected president of the New England Power Service Co., servicing unit for the entire system. Mr. West is a native of Alabama, and in his third year at Harvard was called home

Bachrach

to carry on the work of his father, who was owner of the electric company in Montgomery. Since then his utility activities have taken him to many parts of North and South America, as well as to Europe.

He was the first power sales engineer on the staff of the Charles H. Tenney & Co. organization at Boston, and later served as a consulting engineer specializing in the construction of utilities in many parts of the United States. Mr. West became associated with the New England Power group about ten years ago as operating manager of a group of companies located northeast of Boston. His headquarters will be at Worcester.

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▶ ALFRED H. CUNNINGHAM has been appointed credit manager of the Westinghouse Electric & Manufacturing Co. to succeed L. H. Lund, recently elected treasurer of the company. Mr. Cunningham is also assistant treasurer.

▶ A. L. MARSH, president Hoskins Manufacturing Co., Detroit, has been awarded the Albert Sauveur Achievement Medal by the American Society for Metals. The citation read: "In recognition of his pioneering metallurgical achievements, which have stimulated organized work along similar lines to such an extent, that a marked basic

advance has been made in metallurgical knowledge." Mr. Marsh is the inventor of nickel chromium heating wire, which forms the basis of the heating units in ranges, water heaters and other domestic electrical appliances. He is an active member of the electrical alloy section of the National Electrical Manufacturers Association.

•

H. H. Barnes, Jr., Retires As G. E. Vice-President

H. H. Barnes, Jr., General Electric commercial vice-president, retired on January 1, after completing 40 years of service with the company. Mr. Barnes has been in charge of the company's activities in the New York district since 1928.

After obtaining his early experience with Siemens & Halske in Germany, where he received his technical education, and with the Mexican Electric Works, Ltd., in Mexico City, he became identified in 1902 with the Stanley Electric Manufacturing Co., predecessor of General Electric's present plant at Pittsfield, Mass. In 1907 he was transferred to the New York district and in 1928 became district manager. It was in 1930 that Mr. Barnes was elected a commercial vice-president.

E. P. WALLER, assistant to E. O. Shreve, vice-president in charge of apparatus sales, has also retired after completing 41 years of service with the company. Mr. Waller had been manager of the G. E. transportation department for seventeen years before becoming assistant to Mr. Shreve in 1939.

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▶CANDLER R. GORDON has been appointed manager of the Central Power & Light Co. in Beeville, Tex., to succeed H. C. BRINKOETER, resigned. After more than twelve years service with the company, Mr. Brinkoeter resigned to devote his full time to his ranching interests.

▶CHARLES E. CAREY, chief consulting engineer for the Bonneville Administration, has been appointed senior engineer in the Bureau of Reclamation in charge of the arrangements for marketing the power to be developed on the Central Valley Reclamation project in California. Since joining the Bonneville project Mr. Carey has served as rate engineer, principal construction engineer and acting administrator.

▶W. E. O'BRIEN, who has been in charge of domestic appliance sales in the Toastmaster products division, the McGraw Electric Co., Elgin, Ill., has

VULCOID

HERE MAY BE THE ANSWER TO YOUR "WHAT MATERIAL?" PROBLEM

CAUTION should be used in selecting substitute materials ... such as plastics for metals ... to make certain that shortages will not also develop in the substitute selected.

VULCOID is a NON-metallic ... a laminated plastic fibre made in sheets, rods and tubes ... readily fabricated on standard metal working machinery. It is tough ... moisture resistant ... heat resistant and oil resistant. It has high electrical insulating properties and is exceptionally resistant to carbon deposits from electrical arcs. VULCOID is approved by the Underwriters' Laboratory for the insulation of current carrying parts.

VULCOID is a product of Continental-Diamond Laboratory research. Its development has progressed over a number of years. *Its availability at this time is especially opportune because in its production it requires considerably less of present hard-to-get raw materials than do many other NON-metallic products.*

Properties of VULCOID

¼" THICK MATERIAL

Specific gravity 1.35
Tensile Strength 7,000/11,000 PSI
Flexural Strength 16,000/20,000 PSI
Shearing Strength 10,000/12,000 PSI
Compression Strength 36,000 PSI
Moisture absorption 4% to 8%.
(% weight gain in 24 hours immersion)
Dielectric Strength 250/350 volts per mil.

VULCOID may be the answer to your "What Material?" problem. Let us send you Technical Data Bulletin BC-12.

Continental-Diamond FIBRE COMPANY

Established 1895 .... Manufacturers of laminated plastics since 1911

NEWARK • DELAWARE

How well a connector is made is quickly proven when a lineman starts to use it.

The ease with which the nut is removed from the body, perfect mating of nut and body threads, absolutely no cross threading, and wide flats for holding and tightening fully prove the value of good machining of L-M Connectors.

Most important, with L-M Connectors, the lineman does not have to use great force to get high pressure contact between conductors — another feature which results from careful machining and is a big help to the man on the pole.

LINE MATERIAL CO.
MILWAUKEE, WIS.

been appointed general sales manager of both the domestic and commercial Toastmaster sales departments. B. M. RIKER, formerly in charge of commercial appliance sales, Toastmaster products division, has been placed in charge of a newly created industrial department so that he can concentrate exclusively on defense work, which he has been handling for some time.

▶ JAMES H. FLANAGAN, supervising analyst of the Securities and Exchange Commission, has been nominated for membership on the Public Utilities Commission of the District of Columbia. Mr. Flanagan will succeed the late Riley E. Elgen.

▶ WILLIAM M. WORK has been appointed supervisor of office systems of the district manufacturing and repair department of the Westinghouse Electric & Manufacturing Co. Mr. Work joined the company in 1922, and was assigned to the George Cutter works at South Bend, Ind., until 1928. He then served in various capacities in district and East Pittsburgh offices of the sales department until 1939, when he began a series of special assignments at the East Pittsburgh works.

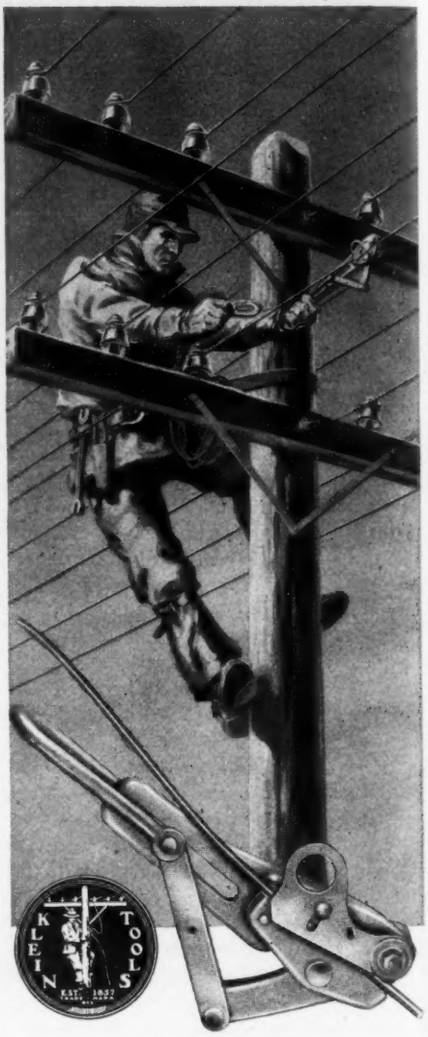
▶ LANE D. WEBBER, tax counsel for the Southern California Edison Co. since 1935, has been elected a vice-president of the company. He will continue as tax counsel, in addition to his new duties as vice-president. Mr. Webber is a member of the board of directors of the California Taxpayers' Association. He has served as a director of the California State Chamber of Commerce and has been identified actively with California civic affairs for many years as an attorney, banker and tax authority. Before his association with the Edison company he was engaged in the practice of law. He was president of the California Bankers Association in 1930.

OBITUARY

Robert S. Hale

Robert S. Hale, 72, retired superintendent of the special research department of Boston Edison Co., died at Westwood, Mass., on January 2. He was a native of Boston, was educated at Harvard and Cornell universities, receiving an M.E. degree from the latter. In 1893 he began work for the Edison company as an office boy, but after two years took up research work in America and Europe for the Steam Users Association, later being connected with the Mutual Boiler Insurance Co., Boston. In 1897 he formed a partnership with John S. Codman at Boston and engaged

TOOLS
HE CAN TRUST



WHEN you are up on a pole—with fifty feet of air between you and the ground—that's when quality in equipment counts—when the quality of the job you do—your safety—your life itself depends upon the tools and equipment you use. It's on the basis of quality and safety first that public utilities—large industrial plants—skilled workmen everywhere—have chosen Kleins as their standard—since 1857.

Your copy of the Klein Pocket Tool Guide will be sent on request.

ASK YOUR SUPPLIER
Foreign Distributor:
International Standard Electric Corp., New York

Mathias KLEIN & Sons
3200 Belmont Avenue, Chicago, Illinois

in electrical merchandising until 1904, when he returned to Boston Edison.

For a time he was engaged in sales administration, and in 1910 was made head of the special research activities of the company, from which he retired in 1931. In the latter field Mr. Hale devoted much attention to rate problems, becoming a national authority on this subject and closely identified with utility studies of cost allocation within and without the old N.E.L.A. organization. He was the founder of the New England System Operators Club and organizer of the Electric Lines Club of that area. Both these organizations and several others with like objectives have not only survived the depressing vicissitudes of the past decade and a half, but have grown in usefulness to the New England utility field as a result of Mr. Hale's foresight.

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Bernard M. Lester

Bernard M. Lester, vice-president and treasurer of the Oklahoma Gas & Electric Co., died on December 24, after an illness of several months. Mr. Lester had been identified with Oklahoma Gas for more than 30 years, working up from the ranks to the position of secretary of the company and general auditor. He became vice-president and treasurer late in 1940.

•

▶ GEORGE H. BOWEN, 75, for many years prominent in electrical signaling activities at Boston, Mass., died at Brookline, Mass., on December 26. He was a native of Bangor, Me., and was a past-president of the Eastern Association of Fire Alarm and Police Signal Inspectors. For ten years before his retirement in 1940 Mr. Bowen was secretary and superintendent of construction and operation for the Boston Automatic Fire Alarm Co.

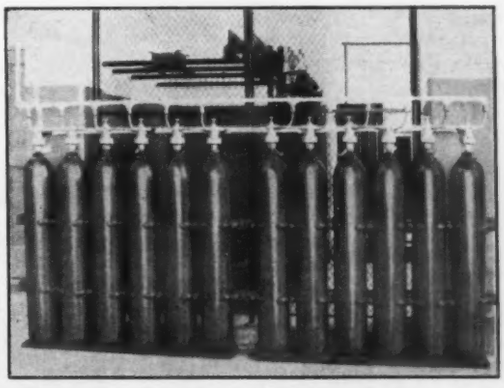
▶ STUART J. MARBLE, manager industrial department, New York district sales of Revere Copper & Brass, Inc., died at the Gotham Hospital, New York, November 24, after a brief illness. Mr. Marble was born in Meriden, Conn., in 1890. He entered the employ of the New York office of the Chase Brass & Copper Co. after graduating from the Meriden High School. In 1912 he became affiliated with the New York office of the Rome Brass & Copper Co., which in 1928 was consolidated with five other companies to form what ultimately became Revere Copper & Brass, Inc. Prior to the consolidation, Mr. Marble was made manager of the New York office of Rome Brass & Copper Co. and had occupied the position he held at the time of his death since the consolidation.

Puget Sound Power and Light Co. Shuffleton Power Plant C-O-TWO Delayed Discharge Control Unit and Remote Electric Control Board.

Automatic, built-in C-O-TWO* fire extinguishing systems at this minute are protecting a large number of the nation's latest and most costly generators and electrical equipment.

It's Safer *Because* It's Faster

In split seconds, a C-O-TWO system releases sufficient non-damaging, carbon dioxide gas to kill fires in generators, oil storage rooms, switch or transformer vaults and all types of rotating units. Automatic C-O-TWO systems are on guard, whether equipment is attended or unattended. Leave nothing to chance in these times. A complete line of Underwriter's Laboratories and Factory Mutuals approved, carbon dioxide fire extinguishing equipment. Write for information.



Puget Sound Power and Light Co. C-O-TWO installation Protecting 35,000 KW Generator — Unit No. 2.

C-O-TWO is a registered trademark. To be safe, specify "C-O-TWO" and this company's name when ordering*

C-O-TWO FIRE EQUIPMENT CO.
10 EMPIRE STREET, NEWARK, NEW JERSEY
Sales and Service in the Principal Cities of United States and Canada

MANUFACTURING - MARKETS

Pledges Production for Victory in War

America's entry into the war overshadows every other event of 1941 for all industries and clarifies the objectives to which they must dedicate themselves in 1942, Roy A. Hunt, president of the Aluminum Co. of America, declared in a year-end statement reviewing the activities of the Aluminum Co. with respect to the national defense program.

Chief developments of importance to the conduct of Alcoa's business were outlined by Mr. Hunt as follows:

(1) Demonstration of the effectiveness of military aircraft, for which the principal construction material is aluminum; (2) attainment of aluminum production by Alcoa at a rate several times that of 1938, the last full peacetime year; (3) completion of major portion of Alcoa's defense expansion, $215,000,000 of the company's own funds; (4) start of construction on more than $90,000,000 worth of government-owned plants which Alcoa contracted during 1941 to build and, in some cases, to operate; (5) reduction of Alcoa's price for aluminum ingot to 15 cents a pound, the lowest level of all time; (6) company's temporary, but complete, foregoing of civilian markets built up over a half of a century; (7) voluntary integration of Alcoa's vast hydro-electric power system with the TVA.

•

Vote to Buy Equipment for New Power Unit

Lansing (Mich.) Board of Water and Electric Light Commissioners has voted to purchase approximately $485,000 worth of equipment for the $3,000,000 addition to the Ottawa Street power plant.

The board has let contracts for structural steel to the R. C. Mahon Co., Detroit, for between $180,000 and $200,000, and for power piping to the National Valve & Manufacturing Co., Pittsburgh, for $180,000.

In addition, the following purchases were made: boiler feed pumps from the Allis-Chalmers Manufacturing Co., $31,580; feed water heaters from the Lumus Co., New York, $35,640; direct contact heaters from the Foster Wheeler Corp., New York, $48,088.

•

Priority Aid Extended

Emergency priority assistance for smelters and refiners of copper, lead, zinc, antimony, mercury and cobalt has been authorized by OPM, which already had provided similar assistance for mines producing these metals. Under the new order a basic rating of A-3 is provided for essential repair, maintenance and operating supplies. Producers will be given an emergency rating of A-1-a for actual breakdown or suspension, and an intermediate rating of A-1-c for necessary advance provision to avert breakdown or suspension. These two latter ratings are available only after advance approval by the Director of Priorities.

Lyle Reports Gains in Air Unit Field

The air-conditioning industry made tremendous strides during 1941, especially in the industrial field, J. I. Lyle, president of the Carrier Corp., has reported.

"Industrial installations by the Carrier Corp. alone were up 76 percent over 1940 and 592 percent over 1934, to reach an all-time high," he said. "In addition, 60 percent of the more than $10,000,000 backlog of orders on Carrier's books is for industrial equipment.

"Comfort installations also increased in 1941, to a point about double those in 1934, but with war needs demanding more and more of the air-conditioning industry's production, the picture for this type of business in 1942 is uncertain," Mr. Lyle pointed out.

•

P. D. Reed Heads OPM Unit

Philip D. Reed, chairman of the board of the General Electric Co., has been named special assistant in charge of industrial branches in the Office of

BUSINESS AND PRIORITIES—Sales representatives of A. B. Chance Co. assemble for four-day meeting to study business conditions and priorities in utility field

Production Management. Mr. Reed has been deputy director of the materials division. In his new office he will receive direct reports from all industrial branches in the division of civilian supply and division of purchases. These branches were being set up, the OPM said, as independent units reporting through Mr. Reed to William S. Knudsen, director-general, and Sidney Hillman, associate director.

•

1,350,000,000 Lamps Sold in U. S. in '41

More than one and a third billion lamps, a new record, were sold in the United States during 1941, according to the General Electric Co. The estimated total of 1,350,000,000 included 718,000,000 large and 610,000,000 miniature incandescent lamps and 22,000,000 fluorescent lamps. Miniature lamps included automobile, flashlight and similar lamps.

While the lamp sales for 1941 showed a substantial increase over 1940—235,000,000 lamps—the real significance was not in the numerical increase, but in the fact that the demand for 200- to 1,500-watt lamps increased 16 percent, while that for the lower-wattage lamps (7½ to 150 watts) gained only 6 percent.

Fluorescent lamp sales, 22,000,000 units more than tripled the 1940 total. Sales in 1938 amounted to 200,000 units, in 1939 to 1,600,000 and in 1940 to 7,000,000 units.

•

Santee-Cooper Project

South Carolina Public Service Authority, Charleston, S. C., has awarded a contract to Perry-Mann Electric Co., Charleston, at $381,243 for furnishing conductors, insulators, line hardware and fittings for new transmission from Pinopolis to Conway, S. C., Santee-Cooper project.

•

Electric Meter Award

Los Angeles Water and Power Bureau, Los Angeles, Calif., has awarded a contract to Sangamo Electric Co. at $123,000 for a quantity of electric meters (Specifications 3574).

New York Metal Prices

	Jan. 6, '42 Cents per Pound	Dec. 30, '41 Cents per Pound
Copper electrolytic	12.00*	12.00*
Lead, A.S. & R. Price	5.85	5.85
Antimony	14.00	14.00
Nickel, Ingot	35.00	35.00
Zinc, Spot	8.64	8.64
Tin, Straits	52.00	52.00
Aluminum, 99 percent	15.00	15.00

* Delivery Connecticut Valley.

7th INTERNATIONAL HEATING AND VENTILATING EXPOSITION

POSTPONED

The serious emergency created by the recent sudden turn of events in the world has made it advisable to postpone the 7th International Heating and Ventilating Exposition which was scheduled to open at Philadelphia on January 26 of this year.

Conditions facing the heating, ventilating and air conditioning industry, the limitations necessarily placed on production for civil use, and the all-out effort to war-condition the Nation have caused manufacturers to feel that exhibiting at this time would detract from the war effort. A poll of all exhibitors indicated that the majority favored discontinuance of the Exposition.

In view of this situation, the Advisory Committee has approved the postponement of the Exposition. This action is endorsed by the Management of the Exposition and will permit all exhibitors to devote every energy to the work of preparing for Victory at the earliest moment possible.

7th INTERNATIONAL HEATING AND VENTILATING EXPOSITION

International Exposition Co.

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Field Reports on Business

A vast transformation of American industry from peacetime to wartime output is being planned by the government, with a $6,000,000,000 production program for the automobile industry getting under way. Additional plant facilities are being made available by further curtailment of consumer goods.

PACIFIC COAST

Pacific Coast wholesalers' annual inventories disclose large stocks, which are considered justified by large and sudden demands along what is practically the western front of supply. Such stocks are largely staple, former overstock items having been sold, to some extent, as replacements for priority items. Government purchasing centers are functioning in their accustomed cities, despite reports of shifting of ranking executive personnel farther inland. Large local defense appropriations are being considered by key Coast cities, and the recent rejection of bids on Parker project poles and material for the Imperial Valley and Central California canals may be indicative of the latter's consequent postponement. Preliminary surveys of Central Valley lines, costing $23,000,000, from Shasta to Upper Bay region had recently been completed; and the State of California had been negotiating with the government on a $68,000,000 project involving dams and plants at Folsom, Auburn, and Coloma in the Central Sierran foothills.

Central station construction and equipment business is particularly good. $3,407,026 was low bid for power house structure and penstocks at Fort Peck, Mont., and a $4,000,000 award was made for second power house building at Grand Coulee. Boulder is buying two 3,000-amp. bus structures and three 4,000-amp. circuit breakers; Los Angeles is asking bids on sixteen 600-amp., 150,000-kva. circuit breakers.

Construction has begun on 2,400 housing units, costing $12,000,000, in San Francisco for Metropolitan Life Insurance Co. Pacific Gas & Electric Co. is figuring plans for its Dutch Flat power house.

NEW ENGLAND

During the past year this area was called upon to play an important part in advancing the defense program and provide machine tools, war material and various kinds of equipment contracted by the Allied nations. In Massachusetts nearly $100,000,000 of private capital was invested in factory expansion, commercial buildings and new homes, a large part of the latter resulting from a pressing need for housing for defense workers.

Production at an accelerating rate is looked forward confidently in 1942. Bookings are heavy in many electrical lines with small motors, switch and control apparatus, line hardware, and a wide variety of motorized apparatus in strong demand. Priority allocations alone obstruct a steady flow of deliveries. Defense equipment orders placed recently include $69,750 worth of reduction gears to General Electric, electric cable amounting to $90,525, awarded to Rockbestos Products Corp., New Haven, Conn.

General Electric has acquired factory buildings consisting of several large units constructed a number of years ago at a cost of $2,000,000 for manufacture of heavy railroad equipment at Fitchburg, Mass. The demand for air raid alarm systems in the coastal district is strong. Boston plans to spend in the neighborhood of $45,000 for air-raid siren-alarm apparatus and wiring supplies; Framingham, Mass., is calling for bids of an unspecified number of units and about 33,500 ft. of non-metallic insulated cable.

American Electric Furnace Corp., Boston, has tripled its floor space as the result of heavy bookings. Boston Elevated Railway has purchased 50 trolley buses at a cost of about $600,000.

NEW YORK

Dislocations resulting from the defense program are beginning to develop in the business structure. So far the automobile industry and affiliated lines, like tires, have been most influenced. However, industrial production of war materials is climbing at a rapid pace, with every effort being made to convert industries to a total war basis.

Engineering construction awards for the short week due to the New Year's Day holiday total $55,032,000, an increase of 10 percent over the volume for the short preceding week, but 33 percent lower than in the corresponding week of 1941 as reported by *Engineering News-Record*. Public construction topped the preceding week by 17 percent, and is 1 percent above the week last year. Private awards, however, are 43 percent lower than a week ago, and 89 percent under a year ago.

Reports indicate that retail trade last year shattered all previous records in both dollar volume and unit sales of merchandise. Total volume approached $54,000,000,000, a figure about 19 percent larger than in 1940. The 1929 peak was $48,459,000,000.

CHICAGO

With government officials making every effort to swiftly convert industries to a total war basis, industrial production of ordnance material in this area is climbing at a rapid pace. Additional plant facilities being made available by further curtailment of consumer goods are speedily being converted to the manufacture of armament equipment. Although considerable unemployment is resulting from these dislocations, adjustments are being made through the steady absorbtion of workers into the production of war material. With all armament production scheduled on a 24-hour-day basis, it is estimated that within six months there will be a sizeable labor shortage.

Electrical manufacturers are pressed to meet the demands for industrial equipment for new plants and for replacement items to increase operating efficiency. Orders for war material are taxing manufacturing facilities. Despite a sharp reduction in residential construction electrical contractors activity continues at record levels.

Bids have been requested on eight metal-clad switchgear with appurtenances for the 68th Street pumping station. War contracts placed here for electrical equipment included Allis-Chalmers Manufacturing Co., switchgear, $20,953; General Electric Co., condenser & parts, $191,082; American Automatic Electric Sales Co., telephone apparatus, $16,719; Sciaky Brothers, welding machines, $73,208.

Manufacturers Issue Earnings Reports

Octave Blake, president of the Cornell-Dubilier Electric Corp., has issued an annual report to the employees and stockholders, containing not only the formal financial statement for the fiscal year ended September 30, but also an interpretation of this statement in the form of an "explanatory balance sheet" for the benefit of the average employee.

For the year ended September 30 gross sales amounted to $6,416,506, compared with $3,958,200 in 1940; net profits, after taxes, were $658,667, or $2.48 per share on 264,640 shares of common stock outstanding, compared with $635,978, or $2.40 a share for the fiscal year ended September 30, 1940. Mr. Blake attributed the rise in sales to three important sources: fluorescent lighting, increased National Defense communications business and power correction capacitors.

Among the other electrical manufacturing companies recently issuing reports are the following:

NASH-KELVINATOR—Fiscal year ended September 30, net profit after all charges, including depreciation, reserves and taxes, $4,617,052, the largest for any year since the merger in 1936. This profit, which is equivalent to $1.07 a share on 4,291,235 outstanding common shares, compares with $1,505,151 earned in the previous fiscal year.

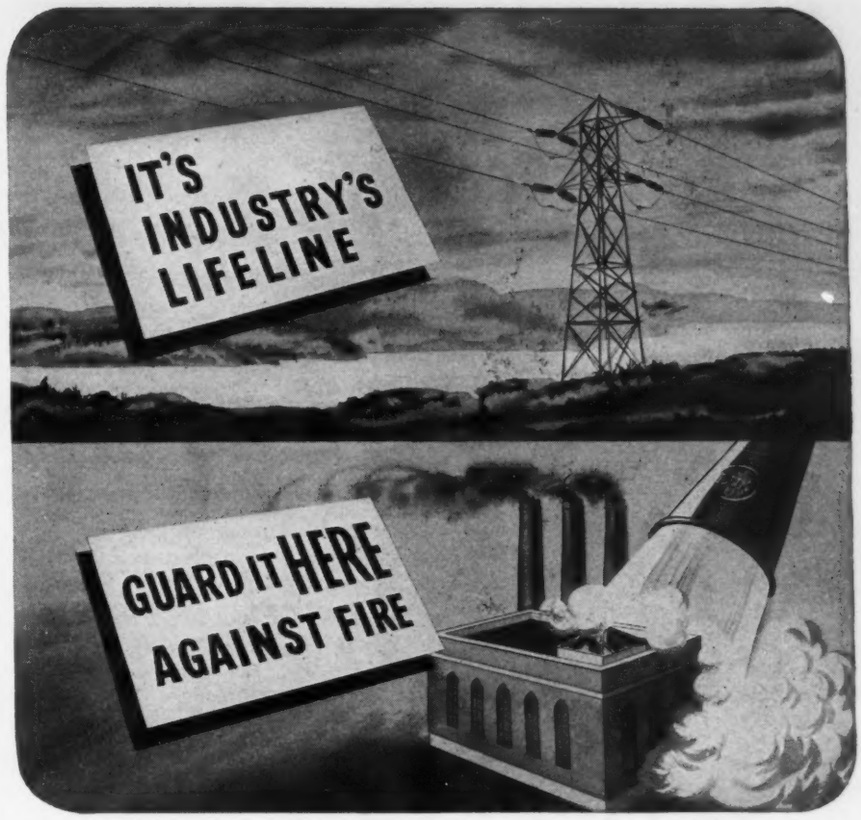
BORG-WARNER — Including subsidiaries, first nine months, net profit, $6,350,930 after depreciation and $8,159,050 provision for Federal income, excess profit and Canadian taxes. This profit is equal to $2.72 a share on 2,336,713 common shares and compares with $4,125,231, or $1.76 a share, earned in the comparable period last year, when tax deductions were $1,784,939.

•

PPD Transmission Line Awards Total $614,935

Consumers Public Power District, Columbus, Neb., has awarded contracts for equipment for new transmission line from power substation at Grand Island, Neb., to terminal substation at Tamora Junction, Neb., totaling $614,935.

Anaconda Wire & Cable Co., New York, N. Y., received the award for copper conductor, at $314,861; Naugle Pole & Tie Co., Minneapolis, Minn., poles, at $58,358; Hughes Brothers, Seward, Neb., crossarms and braces, at $58,679; Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa., protector tubes for lines, at $91,000, and for instrument transformers, at $15,287; Korsmeyer Co., Lincoln, Neb., insulators, at $63,325; General Electric Co., Schenectady, lighting arresters, at $11,781; H. Starr Co., Chicago, calculating board, at $1,644.



One central station fire can darken an entire town, can stop work on every machine. *But it needn't!* The right fire protection can cut outage to a minimum, can keep fire damage to rock-bottom.

England knows the answer! Automatic LUX carbon dioxide extinguishing systems did a magnificent job during the blitz. One LUX installation "extinguished in a few seconds" a switch panel fire caused by a high-explosive bomb. Another snuffed out 4 simultaneous fires in a bombed generating station. Both of these LUX systems were installed in peacetime England. Both installations were ready for action when the emergency struck.

LUX carbon dioxide extinguishers are engineered to *confine fire damage to* point-of-rupture. LUX controls fires in rotating machinery with split-second speed, kills "glow" promptly. This is the kind of fire-fighting that counts heavily when America keeps production rolling steadily . . . uninterruptedly.

If you're planning new construction, plan on LUX protection. *Don't let fire* interrupt production now!

LUX SNUFFS OUT FIRE

Walter Kidde & Company
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Many years of experience in LINE CLEARANCE TREE TRIMMING for PUBLIC UTILITY CORPORATIONS in many states has given the Bartlett Company intimate and expert knowledge of the special problems involved in this work. We solicit your inquiries!

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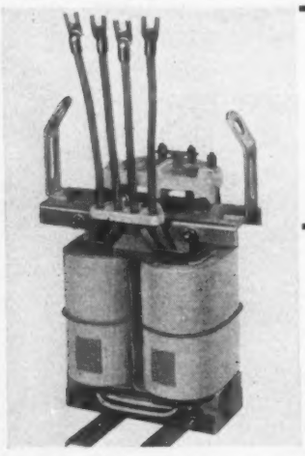
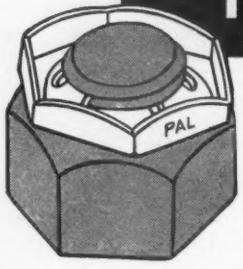
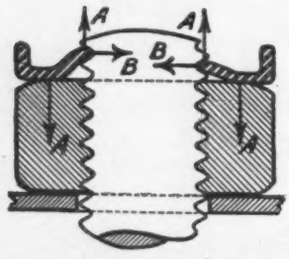


Transformer Connections STAY TIGHT
when nuts are locked with

Double Locking PALNUTS



Once a PALNUT Locknut is tightened, neither severe vibration, shrinkage of materials nor bolt stretch can loosen its powerful double-locking action on nut and bolt. PALNUTS are extensively used on electrical connections and structural parts of transformers. Applied on top of the regular nut, PALNUTS maintain perfect electrical conductivity, eliminating heating or corrosion of contact surfaces. Always specify PALNUTS when ordering power transformers. The cost is trifling. Write today for samples and copy of new Palnut Manual.



When the PALNUT is tightened, its arched, slotted jaws grip the bolt like a chuck (B-B), while spring tension is exerted upward on the bolt thread and downward on the regular nut (A-A), securely locking both.

THE PALNUT COMPANY
Manufacturers of Locknuts and Self-Locking Nuts
51 CORDIER STREET IRVINGTON, N. J.

Bryant Electric Reports 73% Rise in Bookings

Reflecting increased construction activity, the Bryant Electric Co., subsidiary of Westinghouse Electric & Manufacturing Co., reports that orders booked for the first nine months of 1941 are more than 73 percent ahead of the same period last year. The company's backlog is approximately double what it was at the end of 1940 and employment has increased 28 percent over the 1940 average.

The general increase in consumer purchasing power, according to H. E. Seim, vice-president and general manager, also contributed its share in a larger demand for plastic items sold through consumer channels as well as for electric home appliances, for which the company makes many control and attachment devices.

•

Seeks Approval to Sell Substation Facilities

Federal Power Commission has announced its receipt of a joint application by the Associated Maryland Electric Power Corp. and the Youghiogheny Hydro-Electric Corp., both having principal offices in Johnstown, Pa., seeking approval of the sale of the entire properties of the Associated company, which consist of a 22,000-volt transmission line extending from the Pennsylvania-Maryland State line to the Deep Creek power plant of Youghiogheny, together with three substations located along the line, to the Youghiogheny company for $48,110.39 in cash. Upon consummation of the transaction, the application states, the Associated company will be dissolved. Both companies are affiliates of the Associated Gas & Electric System.

According to the application, Associated has sold its entire local distribution system located in Garrett County, Maryland, to the Potomac Edison Co. pursuant to an agreement approved by the Public Service Commission of Maryland. Its remaining transmission and substation facilities are now being used to supply power to Potomac Edison Co. until the Potomac company makes interconnection with its own facilities in Maryland, now under construction.

•

W. W. P. Pays Idaho Taxes

Washington Water Power Co. has just paid $122,747 in taxes on its electrical and water properties in nine Idaho counties, according to W. H. Ude, manager of the claim, tax and right-of-way department. This payment was the first installment for the year 1941.

HOW TO BUILD future BUSINESS by solving IMMEDIATE problems

Company heads find advertising can solve many customer-relations problems other than selling goods

TODAY many company officers are discovering that advertising is a *vehicle of communication;* simply an economical way to get *any* important messages to customers and prospects, quickly and accurately.

Useful *advertising pays today*

One thing you can be sure of today is that *everybody* has new and perplexing problems. Advertising designed to help customers and prospects solve some of those new problems, *right now,* builds *enduring* good-will.

FOR EXAMPLE: A vacuum cleaner manufacturer, short of materials, uses his dealer publication advertising to show retailers how they can keep their doors open, and hold their customers' goodwill, by building up the service end of their business. Thus he *helps* them, even though he can't supply much more than spare parts, right now.

Manufacturers of refrigerators, washing machines, electric irons, or *any* home appliances can find ways to make their dealer paper advertising equally useful.

Generalities help no one

Harassed business men *scour* business papers for *useful* ideas. They'll *study* anything that looks helpful, but they have no time for platitudes or boasts. Business papers offer the *opportunity* to work out advertising that is of *specific* use to special groups of customers and prospects.

That kind of advertising merits managerial attention. Company officers must make sure that they have competent advertising help, must provide adequate funds to achieve sound advertising objectives, and, above all, must give their advertising people encouragement, help, and responsibility.

"How To Find Out What To Say In Your Business Paper Advertising Today"

That is the title of a new A.B.P. booklet which will describe how advertising is being used to solve current problems and expand future markets. Send for it.

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Clip this coupon to your letterhead and mail to ABP, 369 Lexington Ave., N. Y. C., Dept. A.

☐ **"HOW TO FIND OUT WHAT TO SAY IN YOUR BUSINESS PAPER ADVERTISING TODAY"** Described above . . . ready soon.

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☐ **"HOW I HAMSTRUNG MY ADVERTISING AGENCY"** The confession of a business man who found out how to get a real money's worth from his agency's copywriting skill.

LETTER TO THE EDITOR

Utilization of Power Resources

To the Editor of ELECTRICAL WORLD:

With reference to your article "Vast Power Resource Lies Unused," ELECTRICAL WORLD, November 15, 1941, page 50, you have arrived at a convincing conclusion, relative to the fact that variation in the hourly load on a system should be taken up by a better distribution of and changes in the character of the consumers' uses.

There is, I believe, a better arrangement for fully loading prime movers of an electric utility; it is the little-used pumped storage of off-peak power for peak and emergency use. An example is in San Diego, Calif., where water from the Colorado River can be pumped to an elevation of almost 4,000 ft. to existing reservoirs and passed through peak-load waterwheels to existing low level reservoirs. In this case the value of the peak-load power would be so much greater than the value of the off-peak power used in pumping that there would be a large margin of profit.

A somewhat similar case is the proposed lifting of Colorado River water across the high mesa to the low lands near Phoenix, Ariz. Here again there is a high cost power peak to return as revenue greater than the cost of the initial power.

I believe that this pump-storage method, costing less and offering more than any other method of carrying peaks, should have a much more general acceptance.

RALPH BENNETT,
Consulting Engineer,
Los Angeles, Calif.

•

Cleaner Sales Decrease

Vacuum cleaner sales for the month of November totaled 130,985 units, compared with 151,685 units in November, 1940, and 148,920 units in October, 1941.

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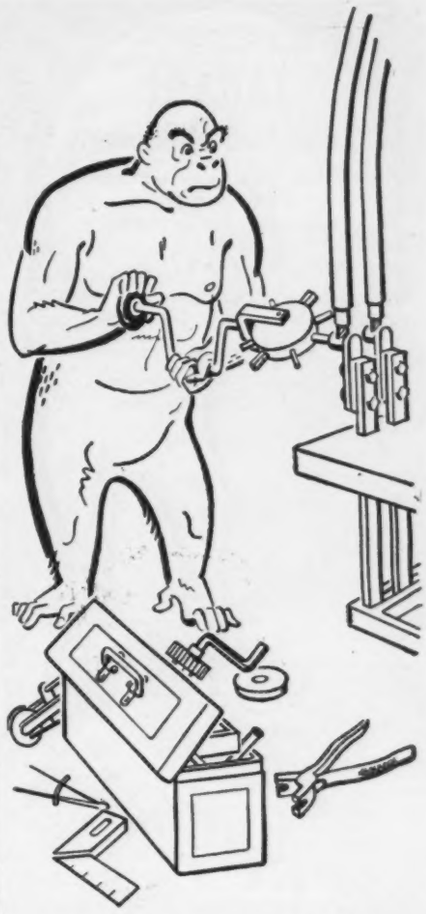
Issue Industrial Survey

Bonneville Power Administration has released an industrial survey of the lower Puget Sound area around Olympia, Wash., giving information needed by industrialists for establishment of new industrial plants. Facts are given concerning nine potential industrial sites totaling 548 acres.



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Pliers or standard wrenches are all that are necessary to make a tight, positive connection when Gorilla Grips are used. And to make them even more convenient and easier to handle, National Electric has assembled stock sets to meet your particular needs and to suit your plant requirements. Write and ask for particulars.

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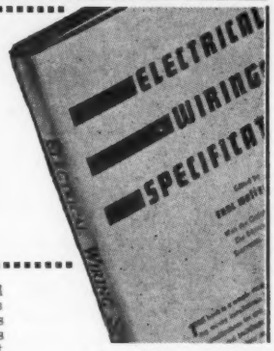

Now you can make sure that plans and specifications tell all and tell it clearly—to help sell the job, and cut down losses from misunderstandings about what's to be done and how it's to be done. This new book gives a simple guiding system—tells in the most concise, direct manner what steps to follow, what data to use—a valuable tool for designers, estimators and contractors.

JUST OUT!

ELECTRICAL WIRING SPECIFICATIONS

By Earl Whitehorne and the Editorial Staff of *Electrical Contracting*

181 pages, 6 x 9, 48 illustrations, $2.50

These chapters tell all

1. Taking the Gamble out of Wiring

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This book gives you a step-by-step procedure for drawing up wiring plans and specifications that will do a better selling job and aid efficient construction. Covers wiring for light, power and signaling—in industrial, commercial, farm, and residential buildings—outlining a simple way of developing specifications, and giving guiding rules of the National Electrical Code, standards, engineering data, and diagrams to simplify your work.

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Sales Opportunities

LIMA, OHIO—Ohio Power Co., Canton, Ohio, has completed plans for new indoor power substation, about 45 x 52 ft., at Lima, and will carry out construction at once. Also, will make extensions in transmission lines for connection with new substation and will expand distribution system.

MERRIMACK, WIS.—Merchants Power & Light Co., Merrimack, recently organized, has secured permission from State Public Service Commission to operate as a public utility, and has plans maturing for several new transmission lines in parts of Merrimack and Greenfield townships, for which authority also has been granted. Distribution lines will be constructed in same area, with service facilities.

SOUTHPORT, N. C.—Municipal Electric Light Department plans expansion and improvements in municipal power plant, with installation of equipment for increased capacity. Cost estimated about $91,100, of which $45,000 will be a federal grant and remainder secured through loan. Work is scheduled to begin soon. Extensions are planned in distribution system, to be carried out at same time.

PLYMOUTH, PA.—United States Engineer Office, Baltimore, Md., receives bids until January 28 for constructing electric power lines and accessory work, complete, at Plymouth (Luzerne County), as per Proposal 68.

WILLIAMSPORT, PA.—Lycoming Motors Division, Aviation Manufacturing Corp., manufacturer of aircraft engines and parts, plans installation of motors and controls, transformers and accessories, switchgear, fluorescent lighting system, conveyors, electric hoists and other equipment in new one-story addition, 380 x 425 ft., for production for government. Cost over $1,000,000. This is part of expansion to be carried out for manufacturer of airplane engines for War Department, Washington, D. C., and for which a gross fund of $3,714,300 will be provided by Defense Plant Corporation, Washington. Work is scheduled to begin at once.

CHICAGO, ILL. — Commonwealth Edison Co. has taken out a permit for alterations and improvements in power substation at 3501 South Pulaski Road, and will carry out work at once. No estimate of cost announced.

TEXARKANA, ARK.—Southwestern Gas & Electric Co., Shreveport, La., plans new 132,000-volt transmission line from Texarkana, where company operates a generating station, to point near Ashdown, Ark., about 22 miles, where connection will be made with high-tension system of Arkansas Power & Light Co., for interconnection between two power sources. Part of joint output will be used for portion of power requirements for new aluminum mill of Aluminum Co. of America, Inc., Pittsburgh, Pa., at Lake Catherine, near Malvern, Ark. Application has been made for permission.

BREMERTON, WASH.—Public Works Office, Puget Sound Navy Yard, Bremerton, receives bids until January 21 for steam boiler and accessories for installation in power plant at local yard, including boiler unit, boiler setting, oil burners, draft fans, preheater, stack, ducts, flue connections, etc. (Specifications 10824).

SOUTH BEND, IND.—Bendix Aviation Corp., South Bend, manufacturer of air-

Remove, Reverse or Replace this point

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PIKE POLES
have these
EXTRA features

- Reversible safety pike point that may be removed and inserted point first leaving no dangerous sharp projection on the truck.
- Removable point is replaceable at negligible cost. No need to buy complete new pole.
- Spiral or straight point available.
- Pole reinforced with ferrule at both head and butt ends.
- Flawless fir pole with heavy lacquer finish.

A·B·CHANCE CO.
CENTRALIA MISSOURI

craft equipment, plans installation of motors and controls, switchgear, transformers and accessories, fluorescent lighting system, conveyors and other equipment in new one-story addition, about 100,000 sq. ft. of floor space, to be used for production of aircraft apparatus for government. Cost about $1,000,000, of which about $700,000 will be used for equipment and machinery purchases, and $300,000 for building and site. Gross fund noted will be secured through Defense Plant Corporation, Washington, D. C., for project.

GORGAS, ALA. — Alabama Power Co., Birmingham, Ala., will issue call for bids soon for construction of addition to Gorgas No. 2 steam-electric generating station, and work is scheduled to begin in about 60 days. Installation will include a 60,000-kw. turbine-generator unit and accessories, high-pressure boiler and auxiliary equipment. Project will be included in 1942 expansion and improvement program of company, and will be completed in May, 1943. Cost is estimated over $4,000,000, including switchyard expansion, extensions in transmission lines and other field facilities.

TACOMA, WASH.—Bonneville Power Administration, Department of Interior, 811 N. E. Oregon Street, Portland, Ore., has plans under way for new power substation near Tacoma, to be used primarily for power supply for new aluminum mill to be constructed for government production by Defense Plant Corporation, Washington, D. C., in that area. Also will build new transmission line from Covington, Wash., to new substation for power supply. Latter work will be carried out early in summer. Entire project will cost close to $1,000,000, including equipment.

GARLAND, TEX.—Brazos River Electric Transmission Cooperative, Inc., Fort Worth, Tex., will furnish power supply for new plant to be constructed near Garland by Guiberson Corp., 1000 Forest Street, Dallas, Tex., for production of Diesel engines for government. Brazos organization will proceed at once with construction of power substation at plant site, and will extend transmission line to that point. Guiberson Corp. will install motors and controls, switchgear, duct lines, industrial lighting system, electric hoists, conveyors and other equipment in plant noted, on which work is being placed under way. It is estimated to cost about $2,411,000, and fund in that amount is being supplied by Defense Plant Corporation, Washington, D. C., for project.

VIRGINIA, MINN.—Northern Electric Cooperative Association, North Sixth Avenue, Fritz E. Anderson, superintendent, is arranging immediate call for bids for primary and secondary lines for extensions in rural electric system in part of St. Louis County, totaling about 296 miles in all, with service facilities. Cost over $260,000. General Engineering Corp., 2944 Cedar Avenue, Minneapolis, Minn., is consulting engineer.

BRIDGEPORT, CONN.—Jenkins Brothers, Main Street, manufacturers of valves and other engineering specialties, plan installation of motors and controls, switchgear, duct lines, electric elevators, industrial lighting system, conveyors and other equipment in new four-story, L-shaped addition, 94 x 191 ft., and 60 x 117 ft., approximating 600,000 sq. ft. of floor space, for production for government. Cost reported about $1,000,000, with financing to be provided by Defense Plant Corporation, Washington, D. C. Fletcher-Thompson, Inc., 1336 Fairfield Avenue, Bridgeport, is architect and engineer.

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WHO USES 'EM
SEYMOUR SMITH
TELEPHONE PRUNERS

Here's Why —

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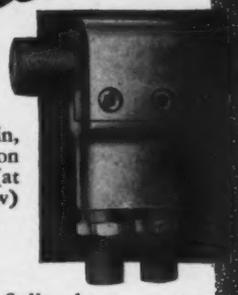

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Split sleeve contact unit gives permanent grip on branch.

Made for single or multiple branch connections.

ALSO CABLE TAPS — a complete line of 90° and Parallel taps, for one or more branches.

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CLAMP TYPE TEES for all sizes of tubing and cable—a full line. Machined contact surfaces.

MANY MORE TYPES— for all combinations. For connecting flat bar, run or tap, to tubing or cable. Also "general utility" tees that take a wide range of conductor sizes. You will find that the Penn-Union line has *exactly what you need.*

FOR ANY CONDUCTOR FITTING—Terminals, Service Connectors, Studs, Two-Ways, Ground Clamps—see the THOUSANDS in the Penn-Union Catalog.

Preferred by the largest users, who have found that *Penn-Union on a fitting is the best guarantee of Dependability.*

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Provide dependable anchoring when poles are subjected to unusual strains from storms. Made of tough, certified, rust resistant, malleable iron for extra strength and holding power. Write for new bulletin.

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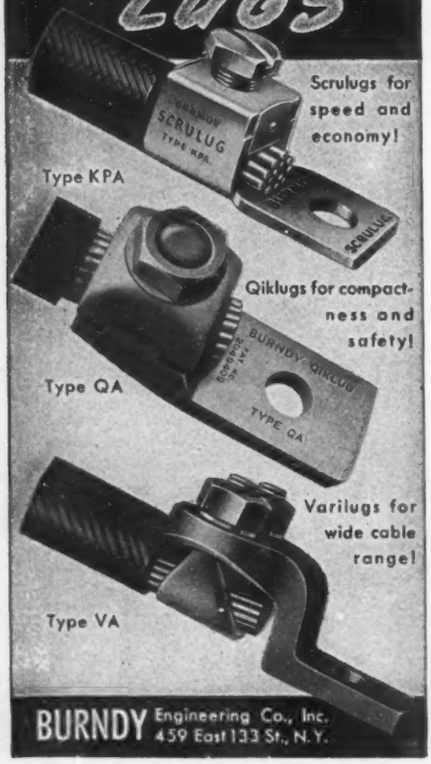

BURNDY Engineering Co., Inc.
459 East 133 St., N.Y.

REA Allots $1,972,000 to Eight Borrowers

Administrator Harry Slattery recently announced allotments totalling $1,972,000 for rural power facilities in six states. This brings total REA allotments to $433,988,321, of which $65,160,700 represents operations during the current fiscal year.

Details of the recent allotments are as follows:

ALABAMA — Marshall DeKalb Electric Cooperative, Albertville, C. M. Elrod, president, $548,000 to build and acquire 409 miles of line, 2,885 members in Marshall and DeKalb counties.

ARKANSAS — First Electric Cooperative Corp., Jacksonville, Ben Marshall, supt., $122,000 to build and acquire 99.5 miles of line, 677 members in Lonoke, Cleburne, Quitman, Faulkner, Pulaski, Prairie, White, Saline and Perry counties. C and L Rural Electric Cooperative Corp., Star City, Lynn Thomasson, supt., $141,000 to build 123 miles of line, 532 members in Lincoln, Cleveland, Jefferson, Drew, Desha and Grant counties. Ouachita Rural Electric Cooperative Corp., Camden, William R. Poole, supt., $220,000 to build and acquire 225 miles of line, 633 members in Calhoun and Ouachita counties.

INDIANA—Orange County REMC, Orleans, Frank Denton, supt., $54,000 to build and acquire 48 miles of line, 300 members in Orange, Washington and Crawford counties.

MINNESOTA—Federated Rural Electric Assn., Jackson, P. L. Ferguson, manager, $140,000 to build and acquire 158 miles of line, 585 members in Martin County.

OHIO — Belmont Electric Cooperative, Inc., St. Clairsville, Harry McAllister, supt., $147,000 to build and acquire 120 miles of line, 705 members in Harrison, Belmont, Monroe, Tuscarawas, Noble and Jefferson counties.

WASHINGTON — Public Utility District No. 2 of Grant County, Ephrata, William H. Long, manager, $600,000 to build and acquire 526 miles of line, 885 members in Grant and Douglas counties.

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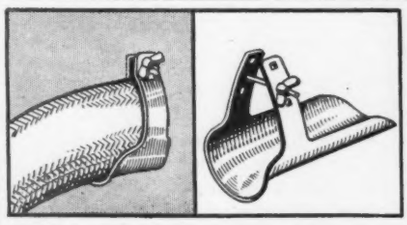
Start Propulsion Units

Construction has been started on a $13,000,000 order for turbine electric propulsion units to drive 35 U. S. Mari-



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These non-corrosive alloy cable shields clamp in place to take wear at duct mouth. Easily and safely installed without interruption of service. Eliminate expensive repairs. Use Staput Fairleaders. Write for free catalog.

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For Public Utilities is provided by Premax Metal Markers and Tags. Easy to install —no upkeep—last as long as the poles.

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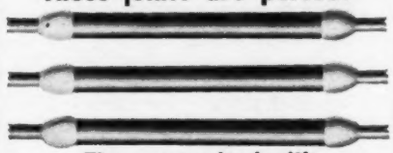
Those joints are perfect



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THE COLOR TELLS THE SIZE

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You can help to save materials by taking particular care of your tree trimming equipment, lubricating where required, protecting from weather when not in use, and by avoiding careless usage.

We are doing our part by maintaining the same high standard of quality which has characterized our product during our many years of service to the electric power industry.

P-46 MAINTENANCE AND REPAIRS. Your co-operation in placing a preference rating on your orders will be most helpful. Under government restrictions we cannot supply manila rope on tree trimmers *except on priority* orders, and similar restrictions will apply to the connecting sleeve used for our sectional tree trimmers.

BARTLETT MANUFACTURING CO.
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For Heavy Metal Cutting . . .

This new Bartlett No. 19 Compound Lever Shear cuts 14 gauge easily. Weighs only 3½ lbs. 20 in. overall. 2¼ in. cut.

Bartlett drop forged compound lever snips are made in 7-8-10-12-14 in. sizes. Write for descriptive catalog page and folder on Compound Lever Snips and Bench Shears.

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"DRESS-UP" "BLACKOUT"
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in suitable colorings

Subox, Inc.
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time Commission tankers, according to R. A. McCarty, Westinghouse vice-president. The equipment is being manufactured in the company's South Philadelphia and East Pittsburgh works. Sun Shipbuilding & Dry Dock Co. will build the tankers at Chester, Pa.

•

Dismisses Utility Plea for Power Development

Federal Power Commission has dismissed the application by the West Virginia Power & Transmission Co. for a major license for a proposed power development on the Cheat River and its tributaries located in Monongalia, Preston, Tucker and Randolph counties, W. Va., and in Fayette County, Pa. Application for license was originally filed by the company in January, 1927.

The order of dismissal follows the company's response to a show-cause order issued by the commission last July, in which counsel for the company advised the commission that, notwithstanding substantial expenditures in connection with the contemplated development, prosecution of the application had been delayed on account of the economic depression during the last decade and due to the confused status of applicable West Virginia law. The company will not oppose dismissal of its application.

•

City Plant Contract Let

City Council, Winters, Tex., has awarded contract to the Universal Construction Co., Guntersville, Ala., for erection of new municipal electric power station. Work will begin soon. A bond issue of $175,000 was authorized recently for the project. H. B. Gieb & Co., Dallas, are consulting engineers. Heretofore service has been furnished by the West Texas Utilities Co.

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HARD PORCELAIN
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Electrical Specialties
High and Low Voltages

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TRENTON, NEW JERSEY

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Against Possible
COPPER WIRE SHORTAGE

And a $244 Saving on
SCRAP WIRE
Splicing with a
KEARNEY
No. 6 ABC MACHINE
and modern, clean-bore
SPLICING SLEEVES

ONE company saw possibilities of a shortage in copper wire. But there was 2800 pounds of No. 6 wire on the scrap heap — and, an on-and-off lineman in the storeroom.

The lineman went to work on that scrap heap with a No. 6 Kearney ABC Sleeve Rolling Machine—used 388 splicing sleeves —spent 60 hours on the job. After deducting time and materials costs from the value of the wire saved, the books showed $244.00 profit—plus 2800 pounds of wire available for emergencies.

So, any company might prepare against copper wire shortage and get profits from the scrap heap . . . Worth investigating, isn't it? Write today — James R. Kearney Corporation, 4236 Clayton Ave., St. Louis, Mo., — *Canadian Plant,* Toronto, Canada.

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Use Simplex Cable Reel Jacks for *really* safe and fast handling of reels. Pay out or take up cable faster and with less damage to the reels. They're under control at all times—no crushed toes—no "run-aways."

- **Lever Type for Speed**
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Thirteen models from which to choose. No. 322 shown lifts on both upward and downward stroke of over bar. Laminated oak "T" base with adjustable tie rods makes them ideal for use on rough ground. Made in pairs for use as shown (322-L and 332-R). See these and other jacks for utilities and electrical contractors in Bulletin U42.

Templeton, Kenly & Co.
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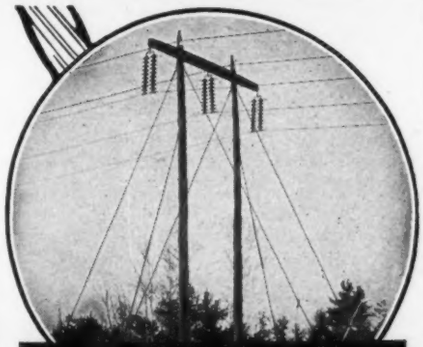
Better, Safer Jacks Since 1899

Simplex Jacks
A better Jack for every job - many jobs for every Jack



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STRENGTH, ruggedness and durability are combined with definite economy in *Crapo* Galvanized Steel Strand. Low first cost, low maintenance expense are matters of record wherever this time-tested product is in use. Available in all standard grades and sizes from representative jobbers throughout the country. Or, write—

INDIANA STEEL & WIRE CO.
MUNCIE, : : INDIANA

BOOK REVIEWS

Air Raid Defense

(Civilian): Curt Wachtel, Chemical Publishing Co., Brooklyn, N. Y. 240 pages, illustrated. Price, $3.50.

Directed to jolt the American complacency about totalitarian war and its resort to incendiary ruthlessness and all sorts of insidious measures this book deals with civilian problems of protection against gas, fire, explosives and the sufficiency of light, sanitation and air in shelters. These portions deal in quantitative terms with the hazards and the counter-measures required for health and comparative safety. The moral is to be organized for every conceivable eventuality, not excluding "heliocopter submarines" dropping aerial bombs on coastal areas.

•

Electrical Reference

Compiled and edited by E. S. Lincoln. Published by Electrical Modernization Bureau, 60 East 42d St., New York. 1,200 pages, illustrated. Price $15.

This book attempts to bring together in immediately useful relation the three elements of applied electrical engineering—theory and basic data, available equipment and the codes and standards that govern installation and use. It does so, conspicuously well, and no apologies are needed on the score that the book is the first of its kind. Divided into 26 comprehensively indexed sections, the book covers a wide range of the practical matters of applied electricity in design, installations, operation and maintenance. A particularly useful feature is the inclusion in each section of that part of the National Electrical Code which applies. Thus an engineer looking for information on a specific point finds in the book the fundamentals of his problem clearly stated, gets a good idea of the equipment needed and learns the requirements for safe installation and operation. To consulting engineers, to industrial engineers and electricians and to electrical contractors the book should be of much value. Purchase of the book entitles the buyer to receive addenda to be printed from time to time to keep the work up to date.

•

Air Raid Precautions

First American Edition. In ten parts, 272 pages, illustrated. Chemical Publishing Co., Brooklyn, N. Y. Price, $3.

This American reprint of an authorized British treatment by experts deals with the precautions to be observed following the raid and this supplements the blackout and alert functions with guidance on rescue, demolition, decontamination, warden organization and equipment. Utility engineers will appreciate the mathematics and data of bomb ballistics, shock velocities and pressures, crater dimensions, structural defense design, shelter ventilation requirements, building resistance, etc., in Part IV. Other parts cover organization and equipment for communication, training of volunteers, gas identification, details of protecting windows, respirator care, the supplies and budgets of equipment for wardens. The whole treatment is quantitative and specific.

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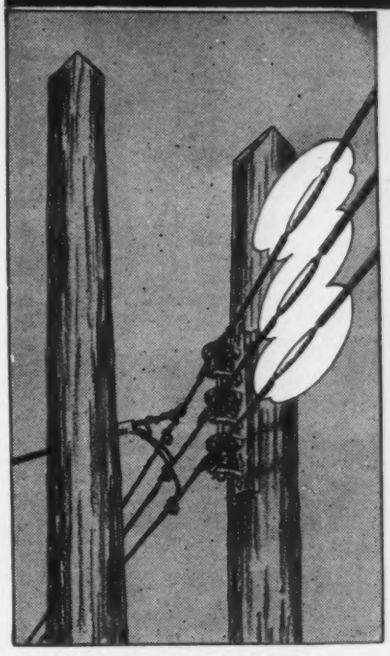

Illustrating simplicity of wiring when a line is moved.

RELIABLE STRAIGHTLINE SPLICE

Carefully designed and engineered, precisely manufactured,—these splices have a record of years of dependable performance. They are now used by most operating companies to make high strength, low cost joints and in emergencies to quickly get the load back on the line.

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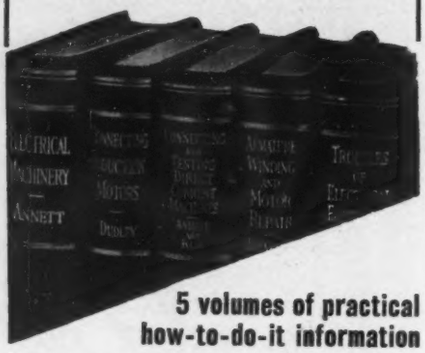
Every phase of electrical maintenance and repair work covered in this Library



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Every man concerned with the care and repair of electrical machinery should have these practical books, with their helpful tables, diagrams, data, methods and kinks. Every one of the five volumes is jammed to the covers with sound, how-to-do-it information—the kind you have to have when anything goes wrong. Liberal use has been made of practical data and practice in repair shops so as to combine the good features of a library of methods with handbook information covering these methods.

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Now, in addition to four well-known practical books on all details of testing, connecting, rewinding, installing and maintaining electrical machinery, the Library includes Stafford's *Troubles of Electrical Equipment*, a new book full of helpful maintenance information, special trouble-shooting charts, explanation of symptoms and causes of machinery troubles, specific remedies, etc. This revised library gives you the ability to handle bigger jobs with surety of results.

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ENGINEER, with experience and sound knowledge of industrial wiring methods and equipment for editorial work on an electrical publication. Should write easily but formal editorial training not essential. P-997, Electrical World, 330 W. 42nd St., New York, N. Y.

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EXECUTIVES AND TECHNICAL MEN, Qualified candidate desiring $2,500 to $20,000 position may contact employers through our confidential services, established 26 years. The National Business Bourse, 20 W. Jackson Blvd., Chicago.

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MANAGER OR SUPERINTENDENT—electric, gas, water, ice, heating utilities. Long and successful experience both large and small properties. Organizing, public relations, load building, operating plants all classes, etc. Eight years present connection. References. Take full responsibility reasonable notice, and get results for you. Not subject to draft. PW-994, Electrical World, 520 N. Michigan Ave., Chicago, Ill.

CIVIL ENGINEER, with 16 years experience in design and construction of Electric Transmission and Distribution Lines, Substations, Power Plants, Earth Dams, Concrete Buildings, and Highways. Now employed, desires change. PW-995, Electrical World, 330 W. 42nd St., New York, N. Y.

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ELECTRICAL ENGINEER — Thoroughly experienced in electrical machine theory, electrical machine design. Licensed Professional Engineer (N.Y.). Formerly college instructor, test engineer, electrical contractor, marine engineer, aircraft technician, radio technician, and electrician. Employed, age 43, married. Prefer position as maintenance electrical engineer or college professor. PW-999, Electrical world, 330 W. 42nd St., New York, N. Y.

POSITIONS WANTED

WANTED: With electrical manufacturer sales position by salesman, 18 years experience selling electrical supplies and equipment throughout New York State and Pennsylvania, including 5 years as sales manager. Can furnish A-1 references. PW-20, Electrical World, 330 W. 42nd St., New York, N. Y.

PHYSICIST with mathematical and statistical training and broad experience including college teaching, proven ability handling people. PW-21, Electrical World, 330 W. 42nd St., New York, N. Y.

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MANUFACTURERS REPRESENTATIVES
15 years experience
Desires one additional line. Preferably lighting or electrical specialty line.
RA-996, Electrical World
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OFFICIAL PROPOSALS

Bids: January 27 (82)

Power Substation

SOUTH CAROLINA PUBLIC SERVICE AUTHORITY
SANTEE-COOPER PROJECT
DOCKET NO. 4329-P-R
CHARLESTON SUBSTATION

1. TIME AND PLACE OF OPENING BIDS: Sealed proposals for constructing the Charleston Substation will be received by the South Carolina Public Service Authority at the office of the Engineer, Harza Engineering Company, 27 Cumberland Street, Charleston, S. C., until 10:00 A. M., January 27, 1942, at which time all proposals will be taken to the Fort Sumter Hotel where they will be publicly opened and read.

2. PROCUREMENT OF PLANS AND SPECIFICATIONS: Proposals must be submitted on the forms furnished by the Authority. These forms, including the plans and specifications and other contract documents, may be obtained from the office of the Secretary of the Authority, Room 508 Peoples Office Building, Charleston, S. C., upon payment of $10.00 for the first set and $3.00 per set thereafter. No refund will be made. These documents may also be examined free of charge at the offices of the Authority, Columbia and Charleston, S. C.; at the offices of the Engineer, 27 Cumberland Street, Charleston, S. C., and 205 W. Wacker Drive,

(Continued on opposite page)